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ABSTRACT

This study, based on data for the 1970-71 school year, develops a uniform method for comparing costs of alternative school feeding systems. The study attempted to determine relative costs of providing meals under alternative production and distribution systems, establish standards relating to food costs and labor efficiency that could be used in appraising the relative performance of a school's food program, and provide management information that could be used in estimating cost changes associated with proposed modifications of an existing school lunch system or in the initial selection of a system. The average costs of providing meals under school owned and operated alternative production and distribution systems are determined, and comparable average costs for commercially provided supplies and services are provided. Findings indicate that the average cost of a meal produced in a self-contained kitchen is 62.9 cents in the North and 48.7 cents in the South. Northern satellite systems provide a meal for 53 cents, but the average is 56.9 cents in the South. Findings also show that labor costs are the biggest source of variation in the preparation of a school lunch, and that contract management and commercially supplied preplate systems are competitive alternatives to school managed and operated systems. (Author/DN)

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THE ECONOMICS OF ALTERNATIVE SCHOOL FEEDING SYSTEMS

Part I. Unit Kitchens and Satellite Systems

Part II. Commercially Provided Services

By

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THE ECONOMICS OF ALTERNATIVE SCHOOL FEEDING SYSTEMS

SUMMARY AND CONCLUSIONS: PARTS I AND II

Rationale for the Study

Most previous school lunch cost studies are reports of single school or district experiences. Comparison of these studies is frequently difficult if not impossible, due to the use of different or unreported cost bases. This study, based on the 1970-71 school year data, develops a uniform method for comparing costs of alternative school feeding systems. Part I of this study determined the average costs of providing meals under school owned and operated alternative production and distribution systems. Part II used the same data gathering and analysis techniques to provide comparable average costs for commercially provided supplies and services.

Objectives of the Study

The objectives of the study were:

1. To determine relative costs of providing meals under alternative production and distribution systems,
2. To establish standards relating to food costs and labor efficiency which could be used in appraising the relative performance of a school's food program,
3. To provide management information which could be used in estimating cost changes associated with proposed modifications of an existing school lunch system or in the initial selection of a system.

School Selection and Systems Classification

The major school owned and operated lunch systems selected for analysis were self-contained kitchens and satellite units, the basic difference being that schools with self-contained kitchens have complete production and serving facilities. Satellite systems have one school designated as the production kitchen. This kitchen produces meals for on-site students and also produces meals for one or more receiving schools. Data are included from a small sample of commissary kitchens. In this type of system all meals produced are transported to receiving schools with no on-site feeding.

The two main commercial alternatives considered were contract management systems and preplated meal systems. The major difference between these two systems is the presence or absence of school-paid food service managers. Contract management provides a substitute for school-paid managers and in some cases, employees to operate school owned equipment. Commercial preplate systems have been used primarily to provide food service where facilities are minimal or lacking altogether. Variations within these alternatives as observed during data collection are outlined and described.

Schools for the first part of the study were selected from the states of New York, Ohio, Pennsylvania, Georgia, Tennessee and Florida. In total, 699 schools were analyzed serving more than 285,000 meals per day. In addition, seven commissary kitchens providing 56,000 meals to 178 schools were analyzed. Data were collected from records of the 1970-71 school year.

Schools selected for the second part were obtained by contacting State School Lunch Directors for the locations of districts using either management services contracts or preplate meal systems. In all, 17 districts utilizing management services and 20 districts using preplate systems were visited in eight northern states. Contract management schools averaged a total of 55,436 meals per day, while schools serving preplated meals averaged a total of 70,614 meals.

Computations

The average per meal cost for each system was obtained by identifying the total quantity spent on each cost component and dividing by the total number of meals served during the accounting period studied. Special attention was given to inclusion of a la carte and special milk program sales as contributors to total cost and labor productivity. Appropriate conversion factors were developed to compute meal equivalents which were added to the total Type A meals served.

Since all schools studied were participating in the National School Lunch Program the Type A meal was assumed to be the minimum level of quality. Satisfactory objective methods for assessment of food quality differences are not presently available and development of such measurements were not within the scope of this study. It should be emphasized that the purpose of the study was to examine relative costs between systems on a common basis. Therefore the costs reported should not be viewed as an accurate reflection of the total cost of producing a lunch for they do not reflect a random sample of schools and some minor cost items were omitted.

Results of the Analysis

Average Costs

School operated systems showed a substantial difference in the average cost of a school lunch in terms of region and/or system. The average cost of a meal produced in a self-contained kitchen was 62.9 cents in the North and 48.7 cents in the South. Northern satellite systems provided a meal for 53.0 cents, but the average was 56.9 cents in the South. The Southern self-contained systems were located primarily in Georgia and Tennessee and the satellite systems in Florida. The Northern systems were predominately from New York with the remainder from Ohio and Pennsylvania.

The average cost of a meal produced in management system operated districts was 59.4 cents. Preplate systems average cost per meal was 58.5 cents. These cost estimates are exclusive of the cost of equipment and space and any intrasystem transportation charges. Including capitalization of the delivery vehicle the cost of transporting meals between production kitchens and satellites is estimated to average approximately two cents per

meal. Field data were not available so no attempt was made to estimate actual equipment and space costs. However, model system, calculated, equivalent annual cost for self-contained kitchens was 12 cents per meal. Satellite systems using hot bulk and preplate meals were calculated as 11 cents and 9 cents respectively, again on a model basis.

Analysis of the individual cost components showed that the average food, supply and repair costs were nearly the same regardless of region and/or system. Labor cost accounted for a high proportion of the variation in the average cost of a lunch. Labor cost is a function of wage scale and productivity. The difference in average labor productivity expressed as meals per labor hour) was approximately 1.5 meals per labor hour between regions and/or systems except for preplated systems. The paramount factor in explaining the difference in average labor cost per meal was the labor cost per hour, which varied between regions by more than a dollar. The labor cost per hour is higher than the stated wage (due to insurance and fringe benefits) and represents what the school actually paid per hour of direct labor. Management system average labor productivity is slightly higher than the school operated system productivity values. Preplate labor efficiency averaged 55.7 meals per labor hour, reflecting the built-in labor of a preplate meal.

Summary of Average System Costs for Type A Equivalent Meals

	North			South		North	
	Self-contained	Satellite	Mixed	Self-contained	Satellite	Contract	Preplate
Purchased food	27.5	26.7	27.0	22.4	25.7	27.9	51.9
Govt. commodities	5.3	5.0	5.3	8.6	6.9	4.5	.5
Food value	32.8	31.7	32.3	31.0	32.6	32.4	52.4
Direct labor	20.2	14.3	19.1	13.7	18.6	17.1	3.8
Direct labor fringes	4.8	2.2	3.0	1.1	2.1	2.8	.4
Admin. costs	3.2	2.7	2.5	1.3	1.3	.3	1.4
Labor cost	28.2	19.2	24.6	16.1	22.0	20.2	5.6
Supply	1.4	1.9	2.2	1.2	2.1	2.5	.4
Repairs	0.5	0.2	0.3	0.4	0.2	0.2	0.1
Management fee	-	-	-	-	-	4.1	-
Total cost	62.9	53.0	59.4	48.7	56.9	59.4	58.5
Estimated costs (model systems)							
Intrasystem transportation	0.0	2.0	0.0	0.0	2.0	0.0	0.0
Equivalent costs for space and equipment[1/]	12.0	9.0-11.0	12.0	12.0	9.0-11.0	12.0	[2/]
Grand totals	74.9	64.0-66.0	71.4	60.7	67.9-69.9	71.4	-

1/ Hot bulk = 11.0
Preplate = 9.0
2/ Not calculated.

The average cost figures for school operated systems presented above included all expenses, whether or not they were paid by the lunch program. Removal of these costs resulted in a reduction of approximately 6 cents per meal regardless of the system in the North, and 8.9 and 7.2 cents for Southern self-contained and satellite systems, respectively. The value of government commodities accounted for nearly all of the reduction. The net or out-of-pocket costs contain labor and repair expenses which, given small changes in participation, remain relatively constant. Food and supply costs tend to vary directly with the number of meals produced. These variable costs were less than 30 cents per meal regardless of region or system. Within the range where labor and repair costs remain fixed, all additional revenue above 30 cents per meal would represent a contribution to overhead and be economically beneficial to the lunch program.

Average total food cost, supply and repair costs were about the same in both school and contract operated systems except for commercially supplied preplate systems which had the highest food cost. The high food cost of preplate systems is explained by the supplies and services included as a part of the meal price. Offsetting decreases in all other cost components bring the average cost per meal to a point that is only slightly higher than Southern satellite kitchen systems and 4.4 cents per meal lower than Northern self-contained kitchens.

Management systems have one additional cost component that other systems do not have. This is the management and administrative fee. A common belief is that management fees simply add to the total cost of the meal. The average costs determined in this study do not support that belief. There were offsetting decreases in average administrative and labor costs per meal which compensate for the addition of the management fees. Average commodity utilization was slightly lower in management systems as compared to the Northern school operated systems. Commodity utilization in preplate systems is low and reasons for this are discussed.

Commissary Costs

Data were obtained on seven Northern commissary kitchens to determine their relative cost of providing meals. The weighted average cost of commissary meals was 53 cents, which was the same as the per meal cost of Northern satellite units. Again, the cost of delivery and equipment and space are not included. Two of the commissaries used all processed foods and had variable costs of close to 40 cents per meal. The other commissaries had variable costs of less than 30 cents, comparing favorably to Northern self-contained kitchens and satellite units.

Variation in School Operated Systems

The variation in the cost components for school operated self-contained and satellite systems was computed to provide standards of comparisons for individual lunch programs. The data showed that all the cost components, including the total cost of a lunch, varied by more than 90 percent. The variation in meals per labor hour was also computed. Schools were classified as being a self-contained kitchen, a satellite production kitchen, a satellite receiving school using hot bulk, or a satellite receiving school using a preplate system. Grouped according to the number of meals served

per day, the results showed a considerable variation in labor productivity within each system and size classification. The average labor productivity in production kitchens was generally less than in self-contained kitchens of the same size. As would be expected receiving schools had higher average labor productivity than corresponding self-contained and production kitchens. School operated preplate receiving schools had substantially higher labor productivity than the same size hot bulk receiving schools.

Commercial Systems

Average per meal cost values for the top and bottom three districts were computed for both management and preplate systems. This shows the range of values included in both total average meal costs plus its cost components. Average purchased food cost per meal in preplate systems shows the greatest variability, while labor and administration costs are about the same in the top and bottom districts. Variability of food cost in preplate systems is linked to menu differences, fixed price contracts and waste.

Management system variations in cost components from the top and bottom three districts are not very great. Management fees, on an average cost per meal, are about the same in the top and bottom districts as the average management fee for all districts.

Detailed Analysis

Using multiple regression techniques, models were developed to account for the variation in total food cost and labor hours required per day. The food cost model showed that for Northern and Southern elementary schools the incremental food cost was approximately 27.5 cents per meal regardless of system type. The incremental food cost for Jr.-Sr. high school meals served in Northern and Southern self-contained kitchens was 29.8 and 32.6 cents, respectively. The incremental food cost of Jr.-Sr. high meals served in Northern satellite systems was 33.5 cents and if served in Southern satellite units, 36.3 cents per meal. A la carte and adult meals had an incremental food cost of approximately 38 and 35 cents, respectively, regardless of system or region.

The dependent variable in the labor model was the direct labor hours required per day. Basically, the model was a function of the type of meal served, system type, regional system interaction terms and use of convenience foods. The regression equation showed that satellite systems normally require less labor than self-contained kitchens, with preplate satellite systems requiring the least. The coefficients of the explanatory variables indicate the change in labor required by a one unit change in the variable(s). With this type of information the change in labor and resulting change in cost can be compared to the unit cost of the variable(s). If the saving in labor cost was more than the increase in expense from using the variable, then its use would be beneficial to the lunch program. In addition, the effect of system type on the labor required to provide school lunches for a given district can be determined. Hypothetical situations were used to demonstrate how these data could be used to make managerial decisions.

A hypothetical school district serving 1500 meals was used to demonstrate the effect of system type on the capital investment for equipment

and space. Present value techniques were used in order to incorporate the time value of money and allow investments with unequal lives to be compared. The example showed that satellite systems require a smaller capital investment per meal than self-contained kitchens. A school operated preplate system required the lowest capital investment. This economic advantage of satellite systems over self-contained kitchens is directly related to the number of receiving schools per production kitchen.

General Observations and Recommendations

A. School Operated Systems

1. This study showed that the cost of labor is the primary factor causing variation in the cost of a school lunch. As the per hour cost of labor continues to increase, the relative efficiency of the different systems in providing meals becomes more important. The average productivity data and the labor regression equation showed that satellite systems can be more efficient than self-contained kitchens. Northern production kitchens had productivity approximately equal to self-contained kitchens with Southern production kitchens somewhat less. However, all receiving schools had higher labor productivity than self-contained and production kitchens, with preplate receiving schools having substantially higher labor productivity than hot bulk receiving schools. In general, more than one receiving school per production kitchen is needed to obtain the labor productivity advantages of a satellite system.

2. The age of the child being fed, region of the country, size and number of schools, wage scale, type and level of fringe benefits, and whether capital costs are included are factors that should be taken into consideration when determining which system would be the best for a school district. Perhaps most important is the ability of the school lunch director to make a system work. Satellite systems are designed to save labor, but have additional operational costs such as transporting meals. In addition to transportation costs, preplate systems have higher supply costs. Unless the manager can offset the additional operational costs with savings in labor, satellite systems will cost more to operate than self-contained kitchens. Satellite systems by themselves do not represent a panacea to the economic problems of providing a lunch under the National School Lunch Program. However, they do represent an opportunity for some school districts to make a significant reduction in their per meal cost. These circumstances may be unique to each school district and, in some cases, to schools within a district. To help in making decisions regarding what systems are best for their situations, school lunch directors need relevant and reliable data. This study was the initial attempt to provide that information.

3. Because of the numerous methods and types of accounting systems, one of the major problems in doing this study was to obtain comparable data. The implementation of a simple, nationwide, uniform accounting system should receive high priority. The accounts need only be detailed to the extent that they provide the information necessary to quantify the major cost components.

4. An extensive educational program should be initiated to provide training in basic economic analysis to school lunch directors at the local

level. These people have considerable expertise in nutritional and related fields, but many lack the training necessary to use economic data in making decisions. State school lunch offices are presently under-staffed for existing programs and most would be unable to undertake this type of a program. A possible solution would be to use the extension service of the land grant colleges.

5. Approximately 1 out of every 5 meals served in the Northern school operated systems analyzed by this study were a la carte. With a la carte programs of this magnitude, inclusion of their costs tend to substantially overstate the per meal cost of a Type A lunch if the meal count is not adjusted upward. Additional work needs to be done in the area of converting other than Type A sales into meal equivalents.

6. School lunch directors normally are only concerned with the operational costs of a system. Capital investment is an important variable affecting the total cost of a school lunch. Savings in equipment and space may offset a significant portion of the operational cost differences of systems. These relationships are hard to see since the cost of new school lunch facilities is usually contained in other school construction. Presently, there is a lack of equipment and space recommendations for the basic satellite systems. These recommendations need to be established and cost estimates applied so that the relative cost differences of space and equipment between systems can be quantified.

B. Contract Operated and Commercially Supplied Preplate Systems

The alternatives of school feeding by contract management and commercially supplied preplated meal systems compare very favorably on an average cost per meal basis with the school operated systems.

There are school district situations where contract managed feeding systems could probably be used to provide meals on a lower average cost per meal basis than under school managed feeding systems. This could be caused by both high labor costs and limited availability of food management expertise.

In elementary school feeding where equipment and facilities are limited and necessary capital funds for construction of a central commissary are unavailable, commercially supplied preplated meals offer a feasible alternative.

The average cost per meal in commercially supplied meals and services systems covered by this study indicates that the inclusion of a profit element (as a part of total costs) does not result in a higher average cost per meal over the school managed and operated feeding systems.

Each school district has its own set of operating constraints which must be taken into consideration before decisions are made to change or add facilities for food preparation. The data presented in this study should be useful to school administrators in comparing their own school lunch system's costs and efficiency to available alternatives in use in other school districts across the country.

Conclusions

1. Labor costs are the most extreme source of variation in the cost of a school lunch mainly due to regional wage scale and fringe benefit differences.

2. Some schools using commercial preplate and school operated satellite systems have a dual advantage in that productivity is higher (i.e., more meals/dollar spent for labor) plus generally the workers in these systems fall below minimum hour requirements for high fringe benefits (i.e., less total dollars spent).

3. Generally more than one receiving school is needed per school operated production kitchen to obtain increased labor productivity advantages.

4. A la carte sales (i.e., other than Type A sales) are an important factor in labor costs and productivity and must be considered in overall comparison of systems.

5. Contract management and commercially supplied preplate systems are competitive alternatives to school managed and operated systems. The inclusion of the profit element does not necessarily result in higher total costs because:

   a. Although commercially supplied preplate meals have a higher "food" cost the inclusion of built-in labor, supplies and services allow offsetting decreases in school expenses bringing the average meal costs in line with other systems studied. Equipment investment cost for this system although not computed are expected to be the least since no production equipment is required.

   b. Although contract management includes a management and administrative fee, offsetting decreases in school administration expense and lower labor costs bring the average meal costs in line with other systems studied.

PART I. UNIT KITCHENS AND SATELLITE SYSTEMS

CHAPTER I

INTRODUCTION

This study was undertaken to compare the relative cost of providing a school lunch using self-contained kitchens and the hot bulk and preplate type satellite systems. School lunch personnel may use the economic information derived from this study to analyze existing school lunch programs or in making decisions with respect to planned physical changes in school lunch programs.

Our nation's public schools operate the largest chain of restaurants in the United States. Since the initiation of the National School Lunch Act in 1946, the school lunch program has become an integral part of the educational package in many schools. The program has grown from only 600 million meals served in 1947 to 22 million lunches daily in 83,000 schools (October 1971). Impressive as this growth record has been, the nationwide level of pupil participation in the school lunch program is still only about 50 percent. In addition, there is a wide variation in participation among regions of the United States. During November 1971, the estimated average daily participation by region was: Northeast, 45 percent; Midwest, 50 percent; Western, 36 percent; Southwest, 63 percent; and the Southeast, 83 percent.[1] Thus, except for the Southeastern region of the United States, there is still enormous potential for expansion of the number of meals served in schools under the National School Lunch Program. In addition, there are approximately 5.6 million students in 18,500 schools without lunchroom facilities.[2]

To encourage participation by students, school lunch directors and school boards have adopted policies designed to keep prices of meals as low as possible. These policies have resulted in the heavy subsidization of many school lunch programs from the school's general funds. As the total demand on the general fund continues to exceed increases in revenue, school administrators are now looking at school lunch programs as profit centers. Consequently, the trend is to force school lunch directors to operate their programs without additional subsidy from the general fund.

Food and labor make up more than 90 percent of the cost of providing a school lunch.[3] The cost of food, especially protein items, has continued to increase dramatically which, when combined with higher wages and fringe benefits, makes the task of providing a lunch at an acceptable cost even more difficult.

School food service is no longer limited to serving lunches. Breakfast programs are already well underway in many school districts and others are planning to initiate them on a large scale. The 1969 White House Conference on Food, Nutrition and Health recommended a comprehensive free

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1 Food and Nutrition Service, United States Department of Agriculture.
2 Ibid.
3 "Results of Food Service Survey," School Management, Vol. 16, No. 2, February 1972, pp. 11-12.

lunch program and expansion of the breakfast program as a means of reaching the goal of adequate nutrition provided as a part of the child's total education program.[4] Likewise, the American School Food Service Association's blueprint for School Food Service and Nutritional Education includes the recommendation that "a meal containing 1/3 of a child's recommended dietary allowance be provided by the schools daily to all pupils without cost to the individual."[5] Thus, schools may be forced to increase the scope of feeding programs in the future.

The problems of low participation, providing meals to the economically needy, acceptance of more fiscal responsibility, and increasing labor and food costs have forced school lunch directors to examine their programs for areas where their costs are excessive and to search out ways to provide a meal at a lower cost.

To determine where inefficiencies exist schools must have standards or benchmarks of comparison for their school lunch programs. Presently, the lack of uniform accounting systems, especially in the North, precludes school districts from making meaningful cost comparisons. Reported costs are normally only those costs which are paid for out of school lunch funds. These costs have little meaning when the program is heavily subsidized. State school lunch personnel are forced to make cost estimates based on the accumulation of the information reported by the local school district. When based on the aggregation of state information, federal estimates are no better than the information originally supplied by the local school district. The net effect is that, at present, local, state and federal school lunch personnel have little information with which they can make program evaluations or even set standards of performance.

While the characteristics of a school may dictate the type of school lunch system employed, new schools or schools remodeling their lunch facilities should be able to incorporate the most efficient school lunch system that can meet their requirements. The cost-per-lunch of the different systems should be an important consideration in deciding which system to use. This is true whether the financing of the existing or an expanded school lunch remains in its present form or is accomplished by increased federal funds. If federal funds continue to be allocated on a per lunch basis, the production of a lunch within or near this allocation is of significant economic importance to the individual school district. To date there has not been a uniform analysis of the basic school lunch systems so that the cost advantage of one system over another can be quantified. Not only is the magnitude of any comparative advantage important, but also when and in what areas these advantages occur.

This study is centered around the cost of providing a Type A lunch. The number of Type A lunches often does not represent the total number of meals served. Many schools serve adult meals, offer a la carte items, and/or allow students to supplement lunches brought from home. Present school lunch records will not

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4 White House Conference on Food, Nutrition and Health, Final Report, p. 220.

5 School Lunch Journal, February 1970, p. 54.

allow the cost of these meals to be separated from the cost of providing the Type A lunch. To avoid a biased per meal food cost and measurement of labor productivity, these other sales have been incorporated into the study.

Previous Work

The feeding of school children is not a recent phenomenon and there is a very extensive literature, most of which has dealt with questions concerning nutrition, menu planning, and the role of school feeding in the total educational picture. A detailed account of the development of school lunch feeding and the National School Lunch Program has been adequately discussed elsewhere.[6]

Few people would disagree with the goal of the National School Lunch Act, but in recent years the progress made in achieving that goal has come under severe criticism.[7] The focus of the critics on who wasn't being fed and amendments in the National School Lunch Act put pressure on the school districts to seek out and provide the economically needy child with a free lunch. The number of needy children being reached rose from 4.1 million in September 1970 to 8.4 million in March 1972. Schools were reimbursed a fixed amount for each free meal served, but school lunch directors claimed that the reimbursement didn't cover the cost of providing the meal. It was reported that the average cost of a school lunch during the 1970-71 school year was 53 cents, while the average reimbursement was only 42 cents during April 1971.[8] This problem, along with increasing food and labor cost, has caused the demand for more information on the cost of providing a school lunch.

To determine the cost of a school lunch and to be able to make equitable comparisons among school districts and from state to state requires uniform accounting procedures. The lack of such procedures has been a chronic problem to the school lunch program and the need for their development has repeatedly been pointed out.[9] The United States Department of Agriculture has recently received from the Washington, D. C. public accounting firm Peat, Marwick, Mitchell and Company, a uniform child food-service accounting system handbook. However, school districts can only be encouraged, not forced, to adopt the accounting system. Consequently, the lack of a large base of comparable data may still be a problem in the future.

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6 See Marion Cronan's book, The School Lunch; a publication from the American School Food Service Association entitled School Food Service Programs or Hunger in the Classroom: Then and Now, op. cit.

7 Among others see Their Daily Bread, a study of the National School Lunch Program by a Committee on School Lunch Participation; Hunger USA, a report by the Citizens' Board of Inquiry into Hunger and Malnutrition; The School Lunchroom: Time of Trial by Bernard Bard.

8 Hunger in the Classroom: Then and Now, op. cit., p. 59.

9 See articles by Creta Subine, "The Mouse and the Astronaut," School Lunch Journal, February 1970, pp. 27-28; Margaretta Plewes and Richard Shupp, "Uniform Accounting Procedures," The Nations Schools, November 1959; "Accountability '70 - Food Service Style," School Lunch Journal, July/August 1970.

Very little work has been done in the area of cost analysis or the provision of data which would enable school personnel to evaluate the management of their school lunch program against other programs with similar characteristics.

A report entitled "20 Million for Lunch"[10] prepared for Educational Facilities Laboratories by Dechert, Hampe and Company, was designed to help school administrators evaluate and plan their school food service facilities. The report described four major types of kitchens used in schools today and the merits of each. In addition, the report discussed the advantages and disadvantages of vending machines and contracting the lunch facilities to professional food service companies.

In response to requests for information on various kitchen systems in use today, the "School Lunch Journal" interviewed five school food directors, all using a variation of three basic kitchen systems--centralized, satellite and individual units.[11] Centralized kitchens were differentiated from satellite in that meals for all schools are prepared in a building apart from any school, while a satellite kitchen is located in a school building. The reports presented some of the basic reasons involved in the selection of the system, the problems solved, how the system functions, and the problems remaining. Unfortunately, the economic data presented varied in presentation, and economic comparisons were invalid.

Relatively few articles provide specific cost data on lunch room operations. One of the few was a summary of a pilot study done by a school district in Tyler, Texas to determine the practicability of withdrawing from the National School Lunch Program.[12] Two schools were withdrawn from the program and "popular foods" were given precedence over the nutritionally-balanced lunches in an attempt to increase participation. While participation increased, the conclusion reached was that the pilot program as carried out would not be economical. Unfortunately, the factors included in computing the cost of the lunches were not itemized.

In a later study, the same school district conducted a 19-day pilot study to determine and exploit the maximum flexibility of the Type A lunch requirements. A special menu providing just those items of food which records showed had the greatest appeal to the students, but within the guidelines of the National School Lunch Program, was offered to all elementary students. The results showed an increase in daily participation of 31 percent. The total cost per lunch served in all elementary schools was reduced from the 1966-67 monthly average of 53 cents to 46 cents during the pilot project. This enabled the elementary schools to show a profit of $89.86 for the 19-day period. This was in contrast to an average monthly loss of $2,378.92 during the first six months of 1966-67. In addition, garbage as a percent of total weight declined from 23 to 17 percent. Again, the factors included in calculating the profit figures were not itemized.

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10 20 Million for Lunch, Educational Facilities Laboratories, 1968.
11 School Lunch Journal, July/August 1966.
12 Doris Parker, "Type A Lunch vs Popular Foods, A Pilot Program Study in Lunchroom Economics," School Lunch Journal, May 1967, pp. 45-56.

A study was reported from Rochester, New York comparing the cost of using convenience vs. conventional foods.[13] A new elementary school was fitted with equipment designed to accommodate convenience foods and disposable tableware. The cost of operating this system was compared to a similar school which was premaking its meals.

The initial results showed that the higher initial costs of convenience foods were more than offset by the savings in labor costs. The use of disposables increased the total cost above that of the conventional school ($137 for a 3-month period), but the initial investment in dishes, utensils, trays, and a dishwasher was avoided. The value of government commodities was added to the cost of the conventional school lunch. Thus, the actual difference would have been larger as more government supplied foods would have been used in a conventional operation. In a personal conversation in December 1970 the school lunch director of the Rochester schools stated that the use of convenience foods had been eliminated. The reasons given were the lack of buying power and the inconsistency of the types of food available from vendors.

Kroener and Donaldson, in a study of 244 Wisconsin schools[14] serving more than 50 Type A lunches per day, found that there wasn't any significant difference at the 5 percent level of probability in the labor time per meal when the schools were classified according to the type of school (elementary, senior high, etc.). When schools were classified according to the number of meals served daily, significant differences were found at the 1 percent level. In general, as the number of meals increased, labor time per meal decreased. No attempt was reported to analyze the effect of equipment or system used on the labor used per meal.

The problem of how to provide nutritionally adequate lunches in urban schools when the installation of kitchen facilities is not feasible led to an intensive study of eight diverse school systems utilizing central kitchens.[15] Four forms of lunches were selected for study--plate lunches, tray pack, soup and sandwich, and packaged lunches. The study reported that physical considerations such as availability of freight elevators and serving space in receiving schools, number of lunches prepared and served at each school, and delivery schedules may limit or force the selection of the kind of Type A lunch that can be offered.

The bulk of the study involved the presentation of a hypothetical situation to expand the lunch program to seven schools where it was not feasible to establish individual kitchens. Initial costs for installation of the lunch program were analyzed and cost estimates for providing regular plate lunches, tray pack, or packaged lunches were given. These estimates were based upon observations in the eight lunch programs studied.

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13 "A Comparison: Convenience vs Conventional in Rochester, N.Y.," School Lunch Journal, March 1968, pp. 16-22.

14 Virginia Kroener and Beatrice Donaldson, "Labor Time in Type A School Lunch Programs in Wisconsin," Journal of Home Economics, June 1958, pp. 451-455.

15 "Establishing Central School Lunch Kitchens in Urban Areas: Problems and Costs," Agricultural Economic Report No. 72, May 1965.

The operating cost per 100 lunches was estimated at $45.41 for the regular plate lunch, $47.69 for the tray pack lunch, and $37.25 for the packaged lunch. The estimate of initial costs for setting up the program with the regular plate lunch was $70,300; for the tray pack lunch it was $43,500. The packaged lunch was assumed to have made use of existing facilities. A soup and sandwich alternative was not analyzed.

The editors of School Management conducted a survey in an effort to obtain information on food service in public school districts.[16] The results reported were based on information obtained from 415 school district food service directors. As shown below the study reported that as the size of the school district increased, the median cost of a school lunch gradually increased. The median figure for all districts was 45 cents and the reported mean was 44.5 cents. Labor productivity (meals per man hour of labor) showed a general decline and then leveled off as district size increased. The decline in labor productivity would explain some of the increase in the median cost of a meal.

School Management School Lunch Survey
415 Districts

School district size	Meals/day	Median cost/meal	Meals/labor hour
0 - 2499	1012	.40	16
2500 - 4999	2100	.43	14
5000 - 9999	3700	.46	15
10000 - 24999	6500	.45	14
25000 +	20250	.49	14

The study summarized in the preceding paragraph lacks uniform calculation and reporting of information at the district level. No attempt was made to differentiate the results by system or region. The lack of availability of data was alluded to by the editors when only 290 of the 415 respondents could break out their cost per meal into percentages for food, labor and other. The breakout reported was that raw food cost accounted for 55 percent of the cost of a meal, labor 40 percent, and other expenses 5 percent. Taken at face value these results would again emphasize the need for information on the importance of the system used to provide the meal on the food and labor cost.

The USDA's Economic Research Service is presently collecting cost information from a total of 160 individual elementary and secondary public schools to construct average lunch cost estimates from a detailed listing of input costs. Personal interviews were conducted with lunch program supervisors at the school or district level for the 1971-72 school year from the beginning of the school term through December 31, 1971.

Preview of Chapters

The school lunch systems selected for analysis are described in Chapter II. Chapter III gives a detailed description of the methodology

16 "Results of Food Service Survey," op. cit., pp. 11-12.

employed to calculate costs and measurements of efficiency associated with the systems described in Chapter II.

The analysis and results of the study are discussed in Chapter IV. After descriptive data, the average cost of providing a school lunch for each system by region is presented. The important differences between average cost and incremental cost and revenue are discussed. Standards of comparison for school lunch cost components and labor productivity complete the chapter.

Multiple regression techniques were used to develop models to explain the variation in food cost and the labor hours required to provide meals. These models are discussed in Chapter V and the important implications that can be drawn from them.

In Chapter VI the equipment and space cost of a hypothetical school district containing four schools and serving 1500 meals per day is estimated for self-contained kitchens and satellite systems. Present value techniques are used to incorporate the time value of money and allow investments with unequal lives to be compared.

Chapter VII deals with how the information derived from the study can be used by school lunch personnel in deciding which school lunch system would be the most economical for their school or district.

Chapter VIII contains a brief summary and the conclusions reached by this study.

CHAPTER II

ALTERNATIVE SCHOOL LUNCH SYSTEMS

A school district is defined as having one or more schools operating under the same central administration. Each school district, and in many cases each school, has special problems or ways of providing a lunch that makes their system unique. However, looking at their common elements, the majority of schools could be classified under the basic systems selected for analysis which were:

1. Self-contained kitchens - Each school operating its own production and serving facilities as a separate entity. This is the typical system used in school lunch programs today, especially in the South.

2. Satellite kitchens - One school designated as the production kitchen produces meals for its own students and produces and transports complete or major components of additional meals to one or more receiving schools in the district. Except for the extra meals it produces, a production kitchen is the same as a self-contained kitchen. The receiving school does a minimum amount of additional preparation. Its primary function would be to serve the meal to its own students.

The form in which the meal is transported to the receiving school differentiates two basic types of satellite systems:

1. Bulk delivery - The hot and cold components of the meal are placed into steam pans and/or other containers and transported to the receiving schools in some type of insulated or electrically heated or refrigerated carts. The food is stored in the carts until served. When properly done, there is very little temperature change between the time the food is placed into the carts and the time it is served. The receiving school normally uses a conventional serving line and, therefore, takes on the appearance of a self-contained kitchen. Students may not be aware that the food is prepared at another location. This method will be referred to as hot bulk.

2. Individual meals (preplate) - After preparation, the food is portioned at the production kitchen into individual meals except for such items as milk and juice which are easier to add at the receiving schools. A common method is assembly of the individual meal into two separate disposable tray-packs. The portion of the meal which is served hot is precooked and placed into a sectioned alumimum foil tray. The cold portion of the meal is packaged in a plastic or paper tray. Both tray-packs are sealed and placed under refrigeration at the production kitchen until they are transported to the receiving school where they are refrigerated until serving time. Just prior to serving, the hot pack is reheated in convection ovens. The students pass by a simple serving counter, often only a table, pick up a hot and cold tray-pack, juice, if served, and milk to complete the meal. A napkin, straw and tableware are usually packed with the cold tray-pack.

Another method of tray packing used is portioned meals in individual, compartmented styrofoam trays with attached lids. Packed into insulated

containers for transport, the meals are delivered to the school, ready to be served. Serving is done in the same manner as with tray-packs.

Neither the tray-pack nor the styrofoam trays readily permit the menu options on a given day that are possible with self-contained or hot bulk systems. Hot bulk, tray-pack and styrofoam trays do allow meals to be served in schools which do not have elaborate kitchen facilities. The latter two, since the meals can be easily eaten in a classroom, allow schools to have a hot lunch program without a formal dining area. Except where inappropriate, the tray-pack and styrofoam method of providing meals will be referred to as preplating.

3. Commissary kitchens - Similar to satelliting kitchens, except that the production kitchen does not serve any student meals; those produced are transported to receiving schools. Commissaries generally produce for a larger number of receiving schools than do satellite kitchens. The smaller commissaries can transport meals using hot bulk or the styrofoam tray, but the larger commissaries, because of timing and transportation problems, normally use the tray-pack method.

Since the vast majority of school districts are too small or diverse to utilize a commissary kitchen, school lunch personnel are concerned mainly with the comparative costs of the self-contained and satellite types of kitchens. While commissaries were considered, the primary purpose of this study was to evaluate the other two systems.

CHAPTER III

METHODOLOGY EMPLOYED IN THE STUDY

Introduction

This section provides a detailed description of the methodology employed to calculate costs and measurements of efficiency associated with different systems. In addition to each cost component, the method of determining the number of meals produced is described.

The primary purpose of this study was to obtain comparable relative cost data representative of the basic school lunch systems. The term "relative cost data" should be kept in mind when reading this study. The study did not involve an indepth study of each school's lunch program. An effort was made to obtain comparable information from a sufficient number of schools so that the results would have broad application. The study was based on the 1970-71 school year.

An alternative method would have been to do an indepth study of a few schools to determine the precise cost of providing a school lunch for each school. This approach was not used as it was felt the results would tend to be limited in the scope of their application. This type of micro-study presumably might follow a macrostudy.

During the summer and early fall of 1971 a feasibility study was conducted in five upstate New York school districts to determine the important cost components of producing a school lunch. The results of the study combined with the suggestions of school lunch personnel showed that the total cost of a lunch is the sum of the following cost components:

1. Total value of food used
2. Cost of nonfood supplies
3. Labor cost
4. Repair and maintenance expense
5. Equipment cost
6. Cost of space used by the lunch program

Each type of school lunch system has the same cost components, but the magnitude of some components for the same level of output varies between systems. The total cost for each system is obtained by quantifying the cost of each component. By dividing total cost by the number of meals, one can obtain average cost on a per meal basis.

Many of the factors affecting the cost of a school lunch are not under the control of the school lunch director. An area where the director can influence lunch cost is in labor cost.

Labor cost per meal is a function of two important variables: labor productivity and the wage scale, including fringe benefits paid to school lunch workers. High labor productivity (meals per labor hour) can offset a high wage scale; hence labor cost per meal may be similar in schools despite differences in wage rates. Because of the interaction of these two variables, it is imperative that systems be evaluated on a labor

productivity basis. If systems were to be evaluated on a labor cost basis, a common wage scale would have to be assigned to insure comparability.

School lunch directors can influence labor cost by increasing the labor productivity of their present system or by deciding to provide meals with an alternative system. Therefore the major emphasis of this study was the measurement of labor productivity on the alternative systems. Information was collected on the cost of labor. However, more attention was given to recording the number of hours required by a school to provide lunches. Throughout the study the time spent by cafeteria aides, who are used in many schools to supervise children during the lunch period, was not charged to the school lunch program. Aides are a result of an administration decision and represent a fringe benefit to teachers. If the hot lunch operation was discontinued and a bag lunch initiated, supervisory help such as aides would still be needed. For the same reason, the labor required to clean the dining room floor and tables was not charged to the lunch program.

The pilot study clearly indicated that because of a lack of uniform accounting procedures among school districts, a personal interview with people connected with the school lunch program in each district was necessary to obtain comparable cost data. The pilot study also revealed the cost components that could be reliably estimated. This knowledge was used to develop the "interview guide" used to collect data during the study. The guide was used to insure that comparable data were recorded by each field enumerator.

The pertinent information on the questionnaire was placed on computer cards and a computer program written to make the basic calculations on each school analyzed.

Selection of States and School Districts

Aided by consultation with personnel of the Food and Nutrition Service of the United States Department of Agriculture, the states of New York, Pennsylvania, Ohio, Tennessee, Georgia and Florida were selected for the study. These states were chosen, in part, because they are recognized by the U.S.D.A. as having well run school lunch programs at the state level and, in part, because they represent different regions.

New York, Pennsylvania and Ohio each contained a sufficient number of school districts of the self-contained and satellite types of kitchens from which schools could be selected for analysis. Georgia and Tennessee were almost exclusively self-contained kitchens. Both states had only a few districts utilizing satellite kitchens. Florida was the only state visited in the South that had a large population of satellite kitchens, which was an additional reason for its selection.

A personal visit was made to each state school lunch director to acquaint them with the objectives of the study and to obtain their cooperation. Each state school lunch director selected provided a cross section of the school lunch program of the types to be analyzed in rural, urban and suburban districts.

Each district visited in Tennessee, Georgia and Florida contained more than one school. All of these states keep a complete set of records, including food and labor expenses, on each school. Consequently, the enumerator could select those he wanted to analyze in each district. Schools were selected on a judgment rather than a random basis. The criteria for selection of schools included: (a) the extent to which the school fit the defined system. Schools using the same system were selected so that they were as comparable as possible except for the number of meals served. Schools using hybrid systems were excluded from the study; (b) the past history of the school with respect to meeting the Type A lunch pattern and maintaining a well run school lunch operation; (c) the school's ability to provide accurate information.

The number of schools selected from each district depended on the size of the district and the amount of time the enumerator could spend in the district.

In New York, Pennsylvania and Ohio the school districts normally contain more than one school, but in general detailed records, especially in the areas of food and supply cost, were not kept separately for each school. As a result, all the schools within a district had to be analyzed in order to determine the per meal cost of the items in which only district totals were kept. Consequently, a large number of schools were included in the sample. The number of meals served and the labor hours per day were available in each school. Hence, labor productivity could be computed, but the food, supply and labor cost per meal had to be calculated on a district basis. Criteria for including an entire district were the same as that used to select schools within a district.

Determination of the Number of Meals Served Per Day

The total number of meals served per day at each school consists of:

1. Student Type A lunches
2. Administration and teachers' lunches
3. Cafeteria and other workers' lunches
4. Meal equivalents of a la carte sales

The general procedure for estimating the average number sold per day in each of these categories was to determine the total number of meals sold during the year and divide by the number of serving days. The number of meals served by a satellite unit (production kitchen plus its receiving schools) would be the summation of the meals per day for each school. Summation of meals per day of the individual schools within each district yielded the district total. The methodology used to estimate each category was:

(1) Type A meals - Federal and state reimbursement policies require that the school district keep a record of the number of Type A lunches served in each school. Monthly reports are submitted to the state school lunch director which give an account of the number of serving days and total Type A meals served. These monthly reports were summed to obtain yearly totals.

(2) Meals served to administrators and teachers - This is the basic Type A meal with some substitution in beverage and size of portions. The meal is not reimbursable under federal and state programs, but most schools, although not required, maintain daily records. These records were used to obtain yearly totals. The number of adult meals served in schools lacking written records were obtained from cash register receipt tapes which the school is required to keep. The type of sale is differentiated on the tape by a code and this was used to estimate the number of meals.

(3) Cafeteria workers - Generally workers in the school lunch program receive a free meal. A record is kept of these meals by some of the school districts. In the schools where a record was not kept, the school lunch director was asked the average number of workers who receive a meal and if there were any additions to this number. The figure was multiplied by the number of serving days, thereby yielding a yearly total. Student workers were not included if their lunch was included in the Type A total. The school lunch director was always queried concerning additional personnel not accounted for in the other categories. Several school districts provide a free lunch to custodial staff and one district provided a free meal to all non-teaching staff. Meals of this type were accounted for and included in the total.

(4) A la carte meals - While the National School Lunch Program stresses the Type A lunch, all schools allow students and adults to supplement lunches brought from home or to purchase additional components of the Type A lunch. The pilot study indicated that present records would not allow the labor and food costs of the a la carte program to be considered separately. As a result, these were converted into meal equivalents. Failure to do so would tend to overstate the food and supply cost per meal and understate the labor productivity measure of meals per labor hour. The extent would depend upon the importance of the a la carte sales in relation to the other cafeteria sales. The schools visited in the South had higher participation by students in the Type A pattern and failure to convert a la carte sales to meals normally would have had little effect on their analysis. However, the a la carte program is a significant part of many Northern school lunch operations and failure to consider this would have had a significant effect on their analysis.

Generally the only record of the volume of a la carte was in terms of dollar sales. Because of the lack of detailed income accounts in the majority of school districts analyzed, total a la carte sales were defined as all other sales except Type A lunches. This includes the monies received from student milk served under the Special Milk Program including the milk served to elementary students in the morning or afternoon, the individual or additional items purchased by adults and students, and unless accounted for separately, the value of adult meals. The total value of a la carte sales was adjusted to obtain net a la carte sales in the following manner: (a) The revenue from the milk served to elementary students other than during the lunch period was subtracted since normally this milk is not distributed by school lunch personnel. Milk of this type will be referred to as "snack milk". (b) The value of complete adult meals (number of adult meals times selling price) was subtracted since these meals were previously accounted for.

The residual (net a la carte sales) was the amount which, if not converted into meals, would bias the analysis.

A major problem was the selection of an appropriate factor to convert dollar value a la carte sales into meal equivalents. State and federal school lunch personnel recognize the problem, but could not offer solutions. The dollar value of a la carte sales would not only be affected by the quantity of items sold, but the pricing policy of the school. School lunch directors trying to maintain or increase Type A lunch sales discourage a la carte sales by pricing individual items high and using the "profit" to supplement the Type A lunch. Other schools make the individual items a "good value" and use the a la carte program to attract students who are allowed to go off the premises for lunch and/or students who wouldn't otherwise participate in the Type A lunch program. Although the latter pricing policy was dominant and the vast majority of schools have approximately the same a la carte prices, an attempt was made to consider the pricing policy of the individual school in the conversion factor.

The net a la carte sales minus the revenue from the Special Milk Program represents the value of all other a la carte items sold. To incorporate variations in the pricing of these items, the school lunch director was asked to price a typical Type A meal in a la carte prices and this total was used to convert the value of all other a la carte items into meal equivalents. This total resulted in a range of conversion factors from 31 to 90 cents and a mean of 60 cents per meal. In schools where this was not possible (i.e., all items of a Type A lunch were not sold a la carte), a conversion factor of 60 cents was used.

A la carte milk presented special problems. Milk sold to students during the lunch period but not with the Type A lunch is eligible for a 4-cent per $\frac{1}{2}$ pint reimbursement under the Special Milk Program. Consequently, schools are able to sell milk for less than the purchase cost, but the reimbursement plus the selling price cannot exceed the purchasing price by more than approximately 1 cent. For example, if the purchase cost to the school was 7 cents, the milk would generally be sold for 3 or 4 cents and the federal reimbursement would make up the difference. The revenue from students for milk constitutes most of the net a la carte sales in many schools. Milk sold under the Special Milk Program for less than cost compounds the problem of converting dollars into meals. As an example, assuming 60 cents in a la carte sales equals one meal and milk is sold for 4 cents, the revenue from 15 one-half pints of milk would equal one meal. However, if the purchase price of the milk was 7 cents, then the cost of that meal equivalent would equal $1.05 which the pilot study showed is approximately three times the estimated food cost of a Type A lunch. If the milk sold for 3 cents and cost the school 7 cents, the food cost of a meal equivalent would be $1.40 which would be approximately 4 times the estimated food cost of a Type A lunch. Evidently, even though converting a la carte sales to meals would reduce the overall bias, revenues from milk sales tend to limit the effectiveness of the conversion because of the Special Milk Program. This problem necessitated differentiating student milk a la carte dollars from other a la carte sales. As with Type A lunches, federal reimbursement policies require that each school keep a record of the $\frac{1}{2}$ pints of milk eligible for reimbursement.

The product of the number of ½ pints of reimbursable milk and its selling price equals the dollar amount of a la carte sales represented by the sale of milk under the Special Milk Program. This value was converted to meals in the following manner: (a) 15 one-half pints of milk was selected as equal to one meal; (b) to take into account a difference in the selling price of milk between schools, a conversion factor for each school was obtained by multiplying the selling price by 15. This would prevent a higher number of meals merely because the school charged 3 rather than 4 cents; (c) the value of a la carte milk was divided by the conversion factor to obtain the number of meal equivalents from selling milk. The adjustment in food cost necessitated by selling milk below cost is dealt with in a later section.

To clarify the discussion concerning conversion of a la carte sales into meal equivalents, a hypothetical example will be worked through.

Assume school A with the following information taken from its school lunch records:

School A

Total a la carte sales for 1970-71	$3,000
Number of adult meals	1,750
Price of adult meals	$.50
Total reimbursable ½ pints of milk	27,000
Snack milk (½ pints)	9,000
Selling price of milk	$.04
Type A lunch in terms of a la carte prices	$.55

Net a la carte sales would be obtained with the following adjustments:

Net a la carte Sales

Total a la carte sales	$3,000
Less: value adult meals	875
value snack milk	360
Net a la carte sales	$1,765

Net a la carte sales would be disaggregated into the value of a la carte milk sales and other a la carte sales. Each of these values would be divided by its conversion factor to obtain meal equivalents.

Meal Equivalents

Value of a la carte milk (18,000 ½ pints x .04)	$720	
Milk conversion factor (.04 x 15)	.60	
Meal equivalents from milk ($720/.60)		1,200
Other a la carte sales ($1,765 - $720)	1,045	
Conversion factor	.55	
Meal equivalents ($1,045/.55)		1,900
Total meal equivalents		3,100

If this school had 175 serving days, then converting a la carte sales into meal equivalents would add approximately 18 meals to the daily total. The importance of this conversion can be shown by taking the example a little further. Assume the school uses 20 hours of labor per day to provide 280 Type A lunches, 15 adult lunches, and 5 cafeteria meals. The meals per labor hour would be 300 divided by 20 or 15.0. Adding the a la carte meals would increase the meals per labor hour to 15.9 (318 divided by 20). If the total cost of food was $90 per day, then the food cost per meal without converting a la carte sales would be $90 divided by 300 or $.300. Consideration of the a la carte meals would change the cost per meal to $90 divided by 318 or $.283. This simplified example demonstrates the importance of considering a la carte sales in analyzing a school's lunch program. Failure to do so would be a more serious error than using a conversion factor with obvious limitations. This would be especially true when comparing school lunch programs where the a la carte sales amount for widely varying percentages of the total.

Determination of Per Meal Food Cost

Estimated food cost per meal was obtained by dividing total annual food cost by total annual number of meals produced using the method of calculating total meals as described previously.

Lunch program food cost was the sum of: (1) value of food purchased by the lunch program including milk, (2) value of government commodities used in the lunch program, (3) transportation and warehousing charges associated with government commodities, (4) value of donated food other than government commodities.

Description of Food Cost Items

(1) Food Purchased - The value of all purchased food items used for the school lunch program during the year. Adjustments in inventories were incorporated in computing this total. Because the milk purchased by the school for all programs is included in this total, two adjustments were required: (a) the total number of $\frac{1}{2}$ pints used in the "snack milk" program was multiplied by purchase price per unit and this total subtracted from the food cost, and (b) the Special Milk Program which allows milk to be sold to students for less than the purchase price, as explained earlier, results in a food cost for the meal equivalent three to four times higher than the estimated true cost. To reduce this overstatement the total number of reimbursable $\frac{1}{2}$ pints of milk (less the snack milk) was multiplied by the reimbursement per $\frac{1}{2}$ pint. The product was subtracted from the purchased food cost. The effect on food cost was to subtract the reimbursement, leaving only the net cost of the milk. The purchased food cost (total - the value of snack milk - the reimbursable milk adjustment) was used as one of the components of the total food cost.

(2) Value of Government Commodities - Government commodities are those food items purchased and distributed under the authorization of several programs by the federal government to schools operating under the National School Lunch Act. The items and quantities available to the school vary depending upon the products defined as surplus. Their

valuation is obtained from a standard price list which is adjusted periodically to reflect the average wholesale cost of similar products to larger school programs, but not necessarily the cost to the government.

(3) Transportation and Warehouse Charges for Government Commodities - The distribution and warehousing procedure for government commodities varies among states, but all school districts are charged a nominal fee for this function. All monetary charges connected with government commodities were included in the total food cost.

(4) Value of Other Donated Food - A few school districts receive donated food from nongovernmental sources. Only one school analyzed received this type of aid. The market value ($29) was included in the total food cost. This category is excluded from the rest of the analysis.

The total value of the food divided by the total number of meal equivalents equals the food cost per meal (FC/M). This calculation could be made for each school visited in the South, but normally it had to be computed on a district basis in the North. Most Northern school districts did not keep individual school records of food used.

Purchased food cost per meal (PFC/M) is the purchased food cost divided by total number of meal equivalents.

The value of government commodities per meal (GC/M) is the value of government commodities divided by total number of meal equivalents.

The cost of transportation and warehousing of government commodities was not calculated directly, but could be computed by subtracting the sum of the purchased food cost per meal and value of government commodities per meal from the total food cost per meal. On a per meal basis, this is an insignificant cost. The weighted state averages ranged from $.001 cents in Florida to $.003 cents in Tennessee and Georgia. New York, Ohio and Pennsylvania all averaged $.002 cents.

The cash or out-of-pocket food cost per meal is the difference between total food cost per meal and the value of government commodities per meal. This takes into consideration both the purchased food cost per meal and the costs associated with the distribution of government commodities.

Determination of the Supply Cost Per Meal

The term "supplies" was assigned to cover all nonfood items used in the production and serving of meals. Items included in the supply cost are: (1) all soaps and other cleaning agents, (2) all paper products including straws, napkins, and products used in serving meals, (3) all disposable dishes and tableware, (4) all other items including pest control and armored car service.

The items that were not included in this category are equipment repair and replacement and fringe benefits or labor costs.

Supply cost per meal (SC/M) is the total supply cost divided by total number of meal equivalents served. This cost was computed on an individual school basis when possible and on a district basis where necessary.

Determination of Labor Productivity

Total labor hours for each school was the sum of the time spent operating the lunch program by the following: (a) school lunch workers, including the school lunch director, (b) student labor, (c) custodial staff, (d) secretarial help, (e) business managers and other administrators.

It was hypothesized that the labor efficiencies (expressed as meals per labor hour) would be different among the basic systems. Advantages in one or more of the basic functions involved in providing a school lunch produce these differences. Consequently, it was not only important to obtain the total labor hours required to provide a school lunch, but to obtain a breakdown of the time required by each of the functions. Four basic functions were identified as being important: (1) preparation, (2) serving, (3) cleaning, and (4) administration. Functional time requirements are not static because of differences in the menu and gray areas exist in determining where one function ends and another begins. School lunch directors were asked to reflect a "normal day" and allocate the labor time of each worker according to the following definitions:

(1) Preparation - time required to complete all the steps before serving began. It included obtaining items from storage, opening containers, mixing, heating, any packaging required, and time expended by serving line back-up staff.

(2) Serving - time required by staff working directly on the serving line including the cashier. Unless of significant length, any lag in the serving line between one group of students finishing and another group beginning, was not analyzed further, but allocated to serving. In general, periods of less than 15 minutes were not allocated.

(3) Cleaning - time allocated to operation of the dishwasher, cleaning the kitchen area, serving line, cooking utensils and equipment. Generally, this represented the time after serving had ended unless there was a definite period during or after preparation for washing equipment. The study was not concerned with such details as a sauce pan being cleaned and reused--whether the time should be allocated to cleaning instead of preparation. However, any period between preparation and serving spent in cleaning type operations was allocated to this function. Cleaning did not include the dining room area, but did include time spent by employees removing garbage.

(4) Administration - time spent by the school lunch director except for any time normally spent in the functions above. Time spent by the cashier or other personnel recording and banking money or keeping records was considered administrative. The time spent by secretaries, business managers, etc., in a supportive role was also included in this function.

The information above was used to compute for each school and type of system the following indexes of labor productivity:

(1) Meals per labor hour (M/LH) - A measurement of the productivity of the people directly involved in the production of a meal. This was the total time, referred to as direct labor hours, spent by food service workers, students and custodial staff. If workers were paid during their lunch period, this time was subtracted in order to be comparable with workers who were not paid. Direct labor did not include the school lunch director unless part of her time was allocated to functions other than administration. Therefore, if she was paid for 7 hours per day and 6 hours were allocated to administration, only one hour was included as direct labor. Likewise, direct labor did not include the administration time spent by other school personnel.

Defining direct labor hours in this manner was an attempt to isolate the time required to provide a meal by each system type. The amount of administration each school or district lunch program utilized is not regarded as a system related variable but as an independent decision, thus not considered in this analysis. To include this time in a measurement of system productivity would not truly be representative of the system. An example may make this point clearer. Assume a school district contained only one school and used 40 hours of direct labor plus 7 hours of administration labor to provide 500 meals per day from a self-contained kitchen. The meals per labor hour for the direct labor would be 12.5, and including the school lunch director, 10.6. Consider a second school district with 4 schools: one of which serves 400 meals from a self-contained kitchen and uses 33.5 hours of direct labor. The school lunch director works 7 hours a day and allocates 1.75 hours to each school. The size and type of system in the other schools is not important for this example. The meals per labor hour considering only the direct labor would be 11.9, and including the time allocated by the school lunch director, 11.3. When the school lunch director's time was included, the better labor productivity of the second district compared to the first was not a function of the system, but economies of scale in administration. To remove the effect of district organization and practices, labor productivity indexes were computed only for direct labor hours.

Meals per labor hour (M/LH) is the average number of meal equivalents per day divided by total direct labor hours per day. This figure was adjusted for schools served by a production kitchen as explained below.

(2) Meals per production hour (M/PH) is the average number of meal equivalents per day divided by direct labor hours of production. This was straightforward for self-contained kitchens, but computation for satellite units was more difficult.

Since the production kitchen produces meals for the receiving schools and itself, the meals per labor hour quotient was very low when only its meals were considered. Using the total number of meals produced in the production kitchen does not reflect true meals per production hour if additional preparation is done at the receiving schools. An individual receiving school had a very high quotient when only the time spent in

additional preparation was considered. It was indeterminant when there was no time allocated to the production function. Generally, receiving schools make use of some direct labor hours in production because of the relative efficiency of delegating such work as juice pouring and portioning of certain items to the receiving school. However, the amount of preparation done at a receiving school varies, even within the same satellite unit, depending on available equipment, distance from the production kitchen, and the discretion of the school lunch director. To reduce the effects of this variation and obtain a comparable parameter, meals per production hour in satellite units were computed in the following manner: The production hours from each receiving school were added to the production hours at the production kitchen. The ratio of this sum to the average number of meals produced per day was the meals per production hour for the entire satellite unit. All schools within a given unit were assigned the same productivity figure. Meals served at each school divided by the common meals per production hour figure gave an estimate of the production hours for which each school was accountable. The net result was that within each satellite unit total production hours were allocated to each school based on respective percentage of total meals served.

(3) Meals per serving hour (M/SH) - The average number of meals per day divided by number of serving hours. The same methodology was used for self-contained kitchens and schools served by a satellite system.

(4) Meals per cleaning hour (M/CH) - The average number of meals per day divided by the number of cleaning hours.

The allocation of production hours in satellite units requires that the total direct labor hours per school be adjusted. Total direct labor hours per school equals the original direct labor hours minus the original production hours plus the allocated production hours. The original production hours were subtracted to prevent double counting. Meals per labor hour in satellite units was obtained by dividing average meals per day by total direct labor hours.

Because of the importance of labor productivity it is imperative that the determining methodology be clearly understood. Thus, the labor productivity of a simulated satellite unit with a production kitchen and two receiving schools will be demonstrated using the basic information given below:

Hypothetical Satellite Unit

Item (per day)	Production kitchen	Receiving school 1	Receiving school 2	System total
Meals	500	300	200	1,000
Direct labor hours	41	12	10	63
Production hours	17	2	1	20
Serving hours	12	7	6	25
Cleaning hours	12	3	2	17
Administrative hours	0	0	1	1

The calculation of the total unit's productivity is the same as a self-contained kitchen. It is obtained by dividing the total number of meals per day by the total labor hours.

Satellite Unit's Productivity Measures

Meals per labor hour:	1000/63 = 16
Meals per production hour:	1000/20 = 50
Meals per serving hour:	1000/25 = 40
Meals per cleaning hour:	1000/17 = 59

The administration time does not represent the school lunch director, but the time spent by the food service workers in administrative work. Since this was not a system-related activity, it was not included as part of the analysis.

The calculation of labor productivity indices for the individual schools within a satellite unit requires adjustments in production and total direct labor hours. The allocation of production hours was accomplished by the division of total meals for each school by the total satellite's meal per production hour.

Allocation of Production Hours

Production kitchen:	500/50 = 10 production hours
Receiving School 1:	300/50 = 6 production hours
Receiving School 2:	200/50 = 4 production hours

The allocated production hours were added to the original total direct labor hours for each school and from this were subtracted the original production hours, resulting in adjusted total labor hours.

Adjusted Total Labor Hours

Production kitchen:	41 + 10 - 17 = 34
Receiving School 1:	12 + 6 - 2 = 16
Receiving School 2:	10 + 4 - 1 = 13

Of course, the combined total labor hours of the three schools remains unchanged, but the meals per labor hour for individual schools can now be calculated.

Meals Per Labor Hour

Production kitchen:	500/34 = 15
Receiving School 1:	300/16 = 19
Receiving School 2:	200/13 = 15

The production kitchen normally has a lower number of meals per labor hour than the receiving schools since the major portion of equipment cleaning for the entire system is done there. No attempt was made to allocate this time between schools.

The indices of meals per serving hour and meals per cleaning hour are not affected by the allocation of production hours.

Meals Per Serving Hour

Production kitchen:	500/12 = 42
Receiving School 1:	300/7 = 43
Receiving School 2:	200/6 = 33

Meals Per Cleaning Hour

Production kitchen:	500/12 = 42
Receiving School 1:	300/3 = 100
Receiving School 2:	200/2 = 100

Determination of Labor Cost Per Meal

To present data on the regional costs of producing a school lunch, it was necessary to estimate labor costs. The method used was to divide total labor dollars for the year by total number of meals.

Originally the labor cost per meal was calculated by dividing normal labor cost per day by average number of meals per day. However the product of this quotient and the total number of meals produced during the year resulted in an annual labor cost significantly lower than the labor cost obtained from the school's records. Investigation revealed that school lunch workers are often paid for significantly more than the number of serving days and that substitutes hired for workers on personal or sick days added to the cost of the lunch program. Consequently, it was felt that using total labor dollars and total meals would be a more accurate method of determining the labor cost per meal.

The total labor cost was comprised of the following parts:

(1) Direct labor cost - wages paid for direct labor (as defined earlier). This included an imputed cost for any program custodial help not normally paid from school lunch funds. It was assumed that any time spent by custodians, clerks, business managers, etc., represented an opportunity cost equal to their hourly wage. Any portion of the school lunch director's time not allocated to administration was also included.

(2) Fringe benefits - the value of benefits paid for employees represented in direct labor cost. Where possible this was obtained directly from the school lunch records. If this was not available, the school lunch director or business manager was asked for the percentage rate of fringe benefits the school lunch workers received. Unless it was known to be different, the imputed labor was assumed to have the same level of fringe benefits. When a percentage figure was used, the dollar value of fringe benefits was estimated by multiplying the percentage rate by the cost of direct labor. Adjustments were made in the direct labor cost when it was known that all the workers did not receive any or all of the fringe benefits.

(3) Administration cost - the cost of the school lunch director, her office staff and the imputed value of labor contributed by other school personnel.

(4) Administration fringe benefits - the value of benefits paid for employees represented in administrative cost.

From the information on labor costs, the following computations were made:

(1) Total labor cost per meal - the total labor cost divided by total number of meals. These are yearly totals and incorporate all actual and imputed direct and administrative labor.

(2) Direct labor cost per meal - all actual and imputed direct labor cost divided by the total number of meals.

(3) Direct labor fringe benefits per meal - the total value of fringe benefits paid to direct labor divided by total number of meals.

(4) Percent direct labor fringe benefits - the value of fringe benefits paid to direct labor divided by the value of direct labor.

(5) Administrative cost per meal - total administrative cost (actual and imputed) divided by the total number of meals. This also included the fringe benefits paid to administrative labor.

(6) Out-of-pocket labor cost per meal - value of labor actually paid by the school lunch program divided by the total number of meals. The labor cost included food service workers, school lunch director, her staff and the fringe benefits paid on this labor. The net result was the total labor cost per meal minus the imputed labor costs.

Because of the lack of detailed records, labor costs were computed for the Northern states on a district, not on an individual, school basis. State and regional weighted averages were also obtained by division of total labor cost in each category by total number of meals for each state or region.

Determination of Repair and Maintenance Cost Per Meal

The repair and maintenance cost per meal was obtained by dividing the total repair and maintenance cost by the total number of meals. This formula was used to determine the district, state and regional cost.

Repair and maintenance cost was defined as the monies spent to keep existing equipment in working order. It did not include replacement of silverware or other durables, but service contracts were included. Silverware should be included as part of the cost of equipment. The most common item was refrigeration repair. Northern school districts generally did not maintain detailed repair and maintenance accounts. The information was normally kept in the supply account and was retrieved by going through invoices. This also made supply cost simultaneously available. In many

schools the repair and maintenance was done by the custodial staff and paid for out of the general fund. These districts were not included in the analysis of repair and maintenance cost. This was a subjective decision on the part of the author. Consequently, the results might tend to have an upward bias.

This concludes the section on the methodology of collection of data and calculations used to determine the costs and labor productivity indexes of school lunch systems. Throughout the study extreme care was taken to obtain comparable data. A most challenging aspect in data collection was aggregation and/or disaggregation of available information into a useable and comparable form. Account totals from district records were not accepted at face value. Instead, the enumerator asked for the specific items included or, perhaps more importantly, excluded.

The methodology employed certainly does not represent a new breakthrough, nor was it intended to be. What the study does represent is that for the first time school lunch systems have been analyzed on an inter- and intra-regional basis using comparable data. In this respect, the study is unique.

The only cost components of the model that have not been discussed are the capital costs of equipment and space.

Schools using the same systems and providing an equal number of meals may have large variations in the equipment cost per meal due to differences in the age, quantity and quality of equipment. For the number of meals produced, many schools have excess equipment while others have barely enough.

Equipment fully depreciated by accounting standards can be functionally as valuable as new items. Inaccurate comparisons between systems would result if the value of equipment at each school analyzed was used to estimate equipment costs.

Instead, it was planned to use present price and federal recommendations of equipment and space required by each system for different size lunch operations. Using discounted cash flow techniques, an equivalent annual cost for equipment and space for different size operations could be estimated to reflect the opportunity cost of the money invested. The cost per meal for equipment and space would then be the ratio of the equivalent annual cost for a given size operation divided by the number of meals produced per year.

Neither equipment nor space recommendations were available for any of the systems studied. A division of the Food and Nutrition Service is presently working on recommendations, but they are either in the planning stage or will not be available for several months. Consequently, the cost of equipment and space could not be included as planned.

To demonstrate the importance of equipment and space on the cost of providing a school lunch and the effects of size of school and type of system on equipment and space cost, a hypothetical school district of 4 schools was established. This hypothesized school district is discussed in Chapter VI.

CHAPTER IV

ANALYSIS AND RESULTS OF THE STUDY

Dimension of the Study

In total, 699 schools were analyzed of which approximately 80 percent were in the North (Table 1). The preponderance of Northern schools resulted from the necessity of analyzing complete districts in order to obtain the necessary information. In all, 88 Northern school districts were visited and schools were selected from 27 Southern school districts.

Table 1. Number of Observations by Type of System and State 1970-71

State	Self-contained kitchens	Satellite system	
		Production kitchen	Receiving school
New York	170	47	136
Ohio	33	12	80
Pennsylvania	16	12	41
Region	219	71	257
Florida	2	30	41
Georgia	26	1	1
Tennessee	39	4	8
Region	67	35	50
Total	286	106	307

The largest Northern satellite unit transported meals to 22 receiving schools. However, 75 percent of the units transported meals to 4 or less and 35 percent transported meals to only 1 receiving school (Table 2). The largest Southern satellite unit had 4 receiving schools and the vast majority (74 percent) transported meals to just 1 school.

Table 2. Number of Receiving Schools Per Production Kitchen By Region and System, 1970-71

Region and system	Receiving schools per production kitchen				
	1	2-4	5-7	8 or more	Total
	(number of production kitchens)				
North					
Hot Bulk	24	23	10	2	59
Preplate	1	5	1	5	12
Total	25	28	11	7	71
South					
Hot Bulk	25	9	0	0	34
Preplate	1	0	0	0	1
Total	26	9	0	0	35

The average number of receiving schools per production kitchen was 3.6 in the North and 1.4 in the South. Twelve of the production kitchens in the North transported meals using a preplate and the average number of receiving schools for this type of production kitchen was 5.9. The average number of receiving schools for hot bulk production kitchens was 3.2. In the South only one of the satellite units did not transport meals using the hot bulk method.

The 699 schools served over 285,000 meals per day. This represented more than 1 percent of the total meals served per day under the National School Lunch Program during 1970-71. Approximately 50 percent of the meals were served in self-contained kitchens. Production kitchens served almost as many meals as their receiving schools (Table 3).

Table 3. Average Meals Per Day by Region and System 1970-71

System	Region		Total
	North	South	
	(percentage of meals per day)		
Self-contained kitchens	51	45	50
Satellite production kitchens	21	26	22
Satellite receiving schools	28	29	28
Total	100	100	100

On the average, except for Northern receiving schools, the schools included in this study served approximately the same number of meals per day regardless of the system used (Table 4).

Table 4. Daily Average Meals Per School for System by Region 1970-71

System	Region	
	North	South
	(meals per day)	
Self-contained kitchen	478	544
Production kitchen	597	604
Receiving school	223	473

Average Cost of Providing a School Lunch by Region and System

This section presents data on school lunches differentiated by region and system. As discussed in Chapter III, Northern school data are reported on a district basis, while Southern data represent sampling of schools within districts. Of 88 Northern school districts analyzed, 35 used only self-contained kitchens, 21 used satellite units exclusively, and 32 districts used both systems. Data from Northern districts using both systems are reported under the "mixed" system. All Southern schools were able to be classified according to type of system.

The average daily participation (ADP) in Southern schools was altogether higher than Northern schools. Self-contained kitchens had the highest rate in both regions (Table 5).

Table 5. Selected School Lunch Data by Region and System 1970-71

Item	North			South	
	Self-contained	Satellite	Mixed	Self-contained	Satellite
Average daily attendance	83,677	66,354	191,007	40,152	61,901
Total meals per day	54,042	38,533	111,659	36,473	44,788
			(percent)		
Average daily participation[a]	61.0	55.0	55.9	86.9	68.6
Purchased Type A	68.6	70.1	72.3	67.4	68.3
Free Type A[b]	7.6	5.5	2.2	21.0	16.9
Reduced price Type A	0.7	0.4	0.8	1.7	4.7
A la carte equivalents	17.6	18.7	20.3	5.5	4.9
Adult and cafeteria workers	5.5	5.3	4.4	4.4	5.2
Total	100.0	100.0	100.0	100.0	100.0

a/ The quotient of total Type A plus a la carte by average daily attendance.
b/ May be understated since federal requirements changed on January 1, 1971.

The Southern schools analyzed served more than 1 out of every 5 meals free or at a reduced price which may influence participation rates in the South. Approximately 1 out of 20 meals were served free or at a reduced price in Northern schools. On January 1, 1971 the federal eligibility requirements for free lunches were changed. As a result, the average number of free lunches served in Northern schools may be understated since most were serving substantially more free lunches at the end of the school year than at the beginning.

A la carte meals were more prevalent in Northern schools representing almost 20 percent of the meals served. Southern schools stressing the Type A lunch served less than 6 percent a la carte meals. The magnitude of a la carte meals in Northern schools points out the necessity of taking them into consideration when calculating food and labor cost per meal. In addition, regional ADP figures would be understated by the percentage of a la carte meals.

The correlation between a la carte meals and meeting nutritional requirements is a serious concern of many school lunch personnel. Others point out mere acceptance of the Type A lunch by students does not mean it will be consumed. These directors are willing to provide a la carte items since purchase normally implies consumption.

From an economic viewpoint, a la carte sales would be beneficial to the fiscal operation of the lunch program when they represent incremental sales with a relatively fixed labor cost.

Adult and cafeteria workers' meals account for approximately 5 percent of the total meals served, and if not considered would also influence food and labor parameters.

The schools included in this study showed a substantial difference in the average cost of a school lunch in terms of region and/or system (Table 6). Note that the average food, supply and repair cost per meal is nearly the same regardless of the region or type of system used. The cost of labor accounts for the majority of the variation in the average cost of a lunch. There is a substantial difference in the regional labor cost of self-contained kitchens.

Table 6. Average School Lunch Cost by Region and System 1970-71

Cost component	North			South	
	Self-contained	Satellite	Mixed	Self-contained	Satellite
Total meals per day	54,042	38,533	111,659	36,473	44,788
			(cents per meal)		
Food	32.8	31.7	32.3	31.0	32.6
Supply	1.4	1.9	2.2	1.2	2.1
Repair	0.5	0.2	0.3	0.4	0.2
Total labor	28.2	19.2	24.6	16.1	22.0
Total	62.9	53.0[a]	59.4[a]	48.7	56.9[a]

[a] Cost of transporting meals not included.

Average Labor Cost Per Meal by Region and System

Labor cost per meal is composed of direct and administration labor, but each can be influenced by different factors. Direct labor cost per meal is a function of wage scale, level of fringe benefits and productivity. Differences in any of these variables can cause substantial variation in direct labor cost.

Administration cost is also a function of wage scale and fringe benefits, but more importantly the organizational structure of the school district. Administration cost is not held to be a system related variable, but being essentially a fixed cost, the average cost per meal would vary inversely with the number of meals served.

A disaggregation of the total labor cost in Table 6 shows that all the labor variables are causing variation in the labor cost per meal between regions and systems (Table 7).

Fringe benefits are substantially higher in the North. Social security and workmen's compensation are common to both regions, but retirement, hospitalization, sick leave and paid vacations, and other programs significantly raise the cost of fringe benefits in Northern schools. An individual school district's fringe benefit package was generally offered only to full time workers and not to employees working 2-3 hours

per day. Satellite units hiring part time workers for receiving schools would have fewer full time employees than comparable self-contained kitchens. This, combined with a generally higher labor productivity, would partly explain the lower fringe benefits per meal in Northern satellite systems. The level of benefits are beginning to rise in the South, but with considerable variation between states. The higher level of fringe benefits for Southern satellite units compared to self-contained schools is attributable to the state in which the observations were made.

Table 7. Components of Average Labor Cost Per Meal by Region and System, 1970-71

Component	North			South	
	Self-contained	Satellite	Mixed	Self-contained	Satellite
	(cents per meal)				
Direct labor cost	20.2	14.3	19.1	13.7	18.6
Direct labor fringe benefits	4.8	2.2	3.0	1.1	2.1
Administration cost[a/]	3.2	2.7	2.5	1.3	1.3
Total labor cost	28.2	19.2	24.6	16.1	22.0
	(meals per labor hour)				
Labor productivity	12.60	13.98	12.99	13.22	12.76
	(per hour)				
Labor cost per hour[b/]	$3.15	$2.31	$2.87	$1.96	$2.64

a/ Includes administration fringe benefits.
b/ The product of direct labor cost plus fringe benefits by meals per labor hour.

Administration cost per meal is lower in the South due mainly to the organization of the school district and generally higher participation rates within districts.

The difference of approximately 1.4 meals per labor hour between Northern self-contained and satellite systems is not as large as expected (Table 7). However, the average size of a receiving school is substantially smaller in terms of both ADA and ADP than the average self-contained kitchen. If there are labor economies of scale in producing school lunches, then many advantages of a satellite system in terms of labor productivity cannot be shown unless they are compared to self-contained kitchens of the same size. Labor productivity will be dealt with further in a later section.

Southern self-contained kitchens had higher labor productivity than satellite units. An explanation may be that a majority of the satellite observations came from one state. Within that state the satellite units had a higher average labor productivity than the average self-contained kitchen. Consequently, the satellite units may have higher labor productivity than self-contained kitchens in that state, but not compared to self-contained kitchens in the other Southern states visited.

The wage rate obtained from school lunch directors multiplied by the product of labor hours per day, times the number of serving days, usually underestimated the total labor expense. The labor cost per hour, representing what the lunch program actually paid per direct labor hour, can be substantially higher than the reported wage per hour. This can be shown by two simple examples:

(1) Assume a school lunch worker is paid $2.00 per hour plus 20 percent fringe benefits (retirement, social security and hospitalization insurance). She is paid for 6.5 hours per day including a half hour for lunch. There are 175 serving days, but she is paid for 180 days and in addition receives 10 days of sick and/or personal leave. A substitute is hired when she is absent and receives $2.00 per hour plus social security. The labor cost per hour could be calculated as follows:

Wage including fringe benefits ($2.00 x 1.20)	$2.40
Hours per day	6.5
Labor cost per day	$15.60
Number of days paid	180
Annual labor cost	$2,808
Cost of substitute ($2.00 x 1.05 x 6.5 x 10)	$137
Total annual labor cost	$2,945
Hours of direct labor (6.0 x 175)	1,050
Labor cost per hour	$2.80

(2) Assume a part time worker who receives $2.00 per hour is paid for 3.5 hours including a half hour lunch period and is covered by social security (the only fringe benefit). The labor cost per hour would be $2.45.

Wage including fringe benefits ($2.00 x 1.05)	$2.10
Hours per day	3.5
Labor cost per day	$7.35
Hours of direct labor	3
Labor cost per hour	$2.45

If she received the full fringe benefit package, the labor cost per hour would be $2.80.

Wage including fringe benefits ($2.00 x 1.20)	$2.40
Hours per day	3.5
Labor cost per day	$8.40
Hours of direct labor	3
Labor cost per hour	$2.80

These examples demonstrate how benefits granted to school lunch personnel are difficult to quantify on an individual basis, but can increase the labor cost per direct labor hour. These benefits represent incremental costs only if substitutes are hired or, for example, if the worker participates in the hospitalization program. To avoid individual calculation, but to account for these monies, the total labor cost (including fringe benefits) for direct labor was divided by the total number of meals. The quotient multiplied by the meals per labor hour resulted in the labor cost per hour (Table 7).

The labor cost per hour varied between regions by more than a dollar. This factor seems paramount in explaining the difference in average labor cost per meal. Assigning a common labor cost (including fringe benefits) per hour for direct labor and dividing by the system meals per labor hour would remove variation caused by different wage rates. Using the other cost components from Table 6 and a common labor cost of $2.50 reduced the maximum variation in the average cost of providing a lunch by system and region from 14.2 cents (29 percent) to 4.9 cents (9 percent) in Table 8. Of course, higher labor costs would increase while lower costs would decrease the variation.

Table 8. Average School Lunch Cost by Region and System Assuming Direct Labor Cost of $2.50, 1970-71

Component	North			South	
	Self-contained	Satellite	Mixed	Self-contained	Satellite
	(cents per meal)				
Food	32.8	31.7	32.3	31.0	32.6
Supply	1.4	1.9	2.2	1.2	2.1
Repair	0.5	0.2	0.3	0.4	0.2
Administration	3.2	2.7	2.5	1.3	1.3
Direct labor	19.8	17.9	19.3	18.9	19.6
Total	57.7	54.4[a]	56.6[a]	52.8	55.8[a]

a/ Cost of transporting meals not included.

As Southern school workers continue to receive more and higher levels of fringe benefits, the difference in labor cost between regions will decline.

Variations in the labor productivity of different functions required to produce a lunch give some explanation why systems vary in efficiency (Table 9). The average satellite system was more efficient in the preparation of meals than self-contained kitchens. Northern satellite units require less time cleaning per meal served than self-contained kitchens, but it was essentially the same for Southern systems. The time required to serve meals is influenced by administration decisions and the number of serving lines which may overshadow system differences. In general, preplate receiving schools should be more efficient in serving, with hot bulk receiving schools essentially equivalent to production kitchens and self-contained kitchens.

Table 9. Functional Labor Efficiencies by Region and System 1970-71

Function	North			South	
	Self-contained	Satellite	Mixed	Self-contained	Satellite
	(meals per labor hour)				
Preparation	31.5	37.5	30.4	26.3	30.2
Serving	51.7	49.2	57.0	74.6	59.0
Cleaning	41.4	49.6	46.8	49.6	48.5

Average Food Cost Per Meal by Region and System

Food cost is the other cost component representing a significant percentage of the cost of a school lunch. There was little difference in the average food cost between regions and/or systems, but Southern schools used more government commodities per meal than Northern schools (Table 10). The use of government commodities was nearly the same between system types in the North. The apparent difference between systems in the South was primarily a state, rather than a system, difference. With substantially equivalent regional food costs Southern schools, using more commodities, would have a lower purchased food cost per meal than Northern schools.

Table 10. Components of Average Food Cost Per Meal by Region and System, 1970-71

Component	North			South	
	Self-contained	Satellite	Mixed	Self-contained	Satellite
	(cents per meal)				
Purchased food[a/]	27.5	26.7	27.0	22.4	25.7
Government commodities	5.3	5.0	5.3	8.6	6.9
Total food cost	32.8	31.7	32.3	31.0	32.6

a/ Includes government commodities' warehousing and transportation charges.

Average Supply Cost Per Meal by Region and System

The variation in supply cost per meal was 1 cent or less with any combination of system and region (Table 6). The difference was due mainly to aggregation of satellite system data and differences in the use of disposable tableware and dishes.

Preplate receiving schools have a supply cost of approximately 5-6 cents per meal for the tray-pack or styrofoam container and the general use of disposable tableware. The supply cost per meal for hot bulk receiving schools and all production kitchens should be approximately the same as self-contained kitchens unless disposables are used.

In the South 20 of 50 receiving schools and 3 of the 35 production kitchens, compared to only 1 of the 67 self-contained kitchens analyzed, used disposables. When these districts were removed the supply cost per meal for self-contained kitchens and satellite units was 1.0 and 1.4 cents respectively, compared to 1.2 and 2.1 cents in Table 6. Since items like armored car service, which were included as a supply cost, were found more frequently in Florida than in the other two Southern states, the remaining difference in supply cost is argued to be a state instead of a system difference.

Assuming the same relationships apply in the North, supply cost is approximately 1 cent per meal for all schools except preplate receiving schools or others using disposable dishes and tableware.

Average Repair Cost Per Meal by Region and System

Repair cost per meal is higher for self-contained kitchens than satellite systems in both regions (Table 6). The equipment required to produce meals for the same number of schools would be less for satellite units than self-contained kitchens. Districts with self-contained kitchens require at least one of each major production equipment item in every school. With a single production kitchen in a satellite unit more efficient use of equipment often would reduce the requirements or allow utilization of equipment with larger capacities. Fewer major equipment items should result in satellite units having lower repair costs per meal than self-contained kitchens.

Age of equipment would also influence repair cost. Satellite systems are relatively new compared to some self-contained kitchens, but much of the old equipment has been replaced by new construction and/or federal nonfood assistance funds. As a result, age of equipment is not felt to be an important variable explaining differences in repair cost between systems.

Average Out-of-Pocket Cost Per Meal by Region and System

The average cost figures presented thus far represent expenses, whether or not they were paid by the school lunch program. The main imputed costs were the value of government commodities, custodian services and administration labor when personnel other than the school lunch director had an active part in running the program. It was assumed wages and fringe benefits of the school lunch workers, school lunch director and her staff were paid out of school lunch program funds.

Removal of these imputed costs resulted in reductions of approximately 6 cents per meal regardless of the system in the North, and 8.9 and 7.2 cents for Southern self-contained and satellite systems respectively (Tables 6 and 11). Less than 1 cent per meal of the reduction resulted from imputed labor, the balance being government commodities. The figures in Table 11 represent average out-of-pocket expenses for a school lunch.

Table 11. Average Out-of-Pocket School Lunch Cost by Region and System, 1970-71

Component	North			South	
	Self-contained	Satellite	Mixed	Self-contained	Satellite
	(cents per meal)				
Food	27.5	26.7	27.0	22.4	25.7
Supply	1.4	1.9	2.2	1.2	2.1
Repair	0.5	0.2	0.3	0.4	0.2
Total labor	27.7	18.6	23.8	15.8	21.8
Total	57.1	47.4[a]	53.3[a]	39.8	49.8[a]

a/ Cost of transporting meals not included.

Changes in out-of-pocket costs are very important to the individual school lunch program. The average cost for each component in Table 11 is the quotient representing the total cost divided by the total number of meals. In a typical school with relatively small changes in the number of meals, the total cost of labor and repairs would remain constant. Hence, the average cost would vary inversely with the number of meals produced. Small increases in participation would lower the average per meal labor and repair cost and decreases in participation would increase the average cost per meal.

Disregarding items such as cleaning compounds, the increase in food and supply cost would vary directly with the number of meals produced. Table 11 shows that the change in food and supply cost would be less than 30 cents per meal regardless of system or region. With an increase in participation a portion of the increase in food and supply cost would be offset by a lower average per meal cost of labor and repairs. A decrease in participation would result in lower food and supply cost, but higher per meal cost for labor and repairs.

Changes in total cost must be compared to changes in revenue to determine the net effect on the school lunch program. Table 11 suggests that within the range where labor and repair costs remain constant, revenue of approximately 30 cents per meal would cover the cost of additional food and supplies. When the revenue from an additional lunch is more than 30 cents, it would pay the variable cost of food and supplies, and in addition make a contribution towards paying the fixed cost of labor and repairs. This would lower the average cost of a lunch. Decreases in participation would have the opposite effect since savings in food and supply cost would be less than the decrease in revenue and the average cost of a lunch would increase.

Even with changes in total labor and repair costs it is the total change in revenue compared to the total change in cost which determines the net effect on the school lunch profit and loss statement. As long as increases in revenue exceed increases in costs, or decreases in revenue are less than decreases in costs, the net economic effect will be beneficial.

The range over which participation can change without affecting the amount of labor and repairs required is an individual situation for each school. However, many schools experience substantial (10-20 percent) daily changes in participation according to what is on the menu. Menus resulting in high participation rates are normally handled with the same labor as those which attract fewer students. This would suggest these schools could raise their average participation without additional labor. The type of a la carte items purchased would influence the range over which labor is fixed. Students changing from milk and ice cream to buying complete meals would be harder to accommodate with the same labor than those who are already purchasing the main components but not the complete Type A lunch.

The extent to which convenience foods are being used would also influence the fixity of labor. Additional meals could be handled by purchasing food items which contain labor. The tradeoff would be savings

in labor vs. a higher food cost. The amount of excess capacity in production equipment is an additional important variable which must be considered.

Transportation and Equipment Cost

Neither the labor required nor the costs associated with transportation of meals to receiving schools has been included in any of the data presented. Consequently, the cost of providing meals with a satellite system has been slightly understated. This was done in order to control for the wide variation in methods and costs of transporting meals. Some districts use trucks exclusively for transporting meals, while others share vehicles with other school departments. Some vehicles are new, others are converted buses with little retail value. Some Southern districts use small trailers pulled behind a car. A few schools merely push the food carts from the production kitchen to the receiving school. Driving conditions (i.e. rural or city) as well as distance between and number of schools influence the number of vehicles and time required for transportation. Union contracts may require a driver with a helper, while other schools utilize part-time or custodial help for delivery. The net result is that the cost of delivery under a satellite system is dictated by local conditions. The transportation cost for schools using this system was generally less than 2 cents per meal but with some exceeding 5 cents.

In addition, the cost figures presented have not included a charge for the equipment and space required by the school lunch program. As discussed earlier, these capital costs should be derived on a uniform basis to allow comparisons between systems. This is discussed further in Chapter VI of this report.

Cost of Providing a School Lunch with Commissary Kitchens

A majority of school districts provide meals using self-contained kitchens or relatively small satellite units. Occasionally city school districts provide meals from a commissary kitchen. Under the latter system, all meals are transported to receiving schools.

Data were taken from 7 commissary kitchens to obtain a measure of their relative cost of providing meals. Because of the small number of observations and the uniqueness of each operation, the data are not aggregated, but presented for each kitchen.

The meals produced per day by the commissaries ranged from slightly more than 1,400 to over 16,000 (Table 12). The largest number of receiving schools per commissary was 50, however 3 of the 7 kitchens transported meals to less than 10 schools. The largest 3 commissaries transported meals in a preplate form with commissary number 3 producing meals designed to be served cold instead of being reheated at the receiving school.

Commissaries transporting meals in preplate form served mainly the Type A lunch, but hot bulk kitchens offered more a la carte items (Table 13).

Table 12. Selected Data on Seven Northern Commissary Kitchens, 1970-71

Kitchen	System	Meals per day	Number of receiving schools	Average meals per school
1	Preplate	16,540	46	360
2	Preplate	14,116	50	282
3	Cold lunch	11,821	39	303
4	Hot bulk	4,806	18	267
5	Hot bulk	4,164	9	463
6	Hot bulk	3,447	7	492
7	Preplate	1,430	9	159

Table 13. Type of Meals Produced by Seven Northern Commissary Kitchens, 1970-71

	Commissary						
	1	2	3	4	5	6	7
Meal type	PP	PP	CL	HB	HB	HB	PP
Total meals per day	16,540	14,116	11,821	4,806	4,164	3,447	1,430
				(percent)			
Type A	98.7	92.9	99.0	87.6	80.0	71.7	97.2
A la carte equivalents	0.1	3.9	0.0	8.6	15.1	14.7	0.0
Adult and cafeteria workers	1.2	3.2	1.0	3.8	4.9	13.6	2.8
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Where PP equals preplate, CL equals cold lunch, and HB equals hot bulk system.

Disregarding commissary 6, the variation in the per meal cost was 6.7 cents or 14 percent (Table 14). Commissary 6 appears to be atypical and while it will continue to be included in the tables, it will not be included in the discussion. A weighted average cost of commissary meals (excluding 3 and 6) was 53.0 cents per meal which was the same as the cost per meal of Northern satellite units.

As opposed to self-contained kitchens and satellite units, all cost components, except repair cost, cause variation in the cost of a commissary meal.

Detailed repair cost data were not available, but indications were that it was approximately the same as with satellite units. This was used as an estimate.

Table 14. Average Northern Commissary School Lunch Cost 1970-71

Component	Commissary 1 PP	2 PP	3 CL	4 HB	5 HB	6 HB	7 PP
Total meals per day	16,540	14,116	11,821	4,806	4,164	3,447	1,430
			(cents per meal)				
Food	34.2	35.6	25.9	28.8	28.3	39.7	25.1
Supply	5.5	5.1	6.7	0.9	0.7	1.0	5.1
Repairs (estimated)	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Total labor	15.4	11.0	16.2	18.7	22.4	34.9	24.8
Total[a/]	55.3	51.9	49.0	48.6	51.6	75.8	55.2

a/ Cost of transporting meals not included.
Where PP equals preplate, CL equals cold lunch, and HB equals hot bulk system.

A breakout of the total labor cost indicates that all the labor variables are interacting to cause variation in the total labor cost per meal (Table 15). Using a common labor cost actually increased rather than reduced the variation in the cost of a commissary meal (Table 16). Substantial differences were found in the level of fringe benefits and administration costs.

Table 15. Components of Average Northern Commissary Labor Cost Per Meal, 1970-71

Component	Commissary 1 PP	2 PP	3 CL	4 HB	5 HB	6 HB	7 PP
			(cents per meal)				
Direct labor cost	11.1	8.2	12.5	13.8	13.5	24.6	19.7
Direct labor fringe benefits	2.3	1.4	2.1	1.4	6.8	7.2	3.5
Administration[a/]	2.0	1.4	1.6	3.5	2.1	3.1	1.6
Total labor cost	15.4	11.0	16.2	18.7	22.4	34.9	24.8
			(meals per labor hour)				
Labor productivity	25.29	21.50	14.37	18.48	17.03	11.40	11.33
			(per hour)				
Labor cost per hour[b/]	$3.39	$2.06	$2.10	$2.81	$3.46	$3.63	$2.63

a/ Includes fringe benefits.
b/ Product of direct labor plus direct labor fringe benefits by labor productivity.
Where PP equals preplate, CL equals cold lunch, and HB equals hot bulk system.

Commissary kitchens 1 and 2 had the highest labor productivity expressed in terms of meals per labor hour. These kitchens were large enough to use special industrial type equipment and assembled meals from prepared foods for delivery to the receiving school. Commissary 3 also used industrial type equipment, but produced a different type meal. The remaining kitchens used the same type of equipment as the self-contained and satellite units discussed earlier.

Table 16. Average Northern Commissary School Lunch Cost Assuming Direct Labor Cost of $2.50, 1970-71

Component	Commissary 1 PP	2 PP	3 CL	4 HB	5 HB	6 HB	7 PP
Food	34.2	35.6	25.9	28.8	28.3	39.7	25.1
Supply	5.5	5.1	6.7	0.9	0.7	1.0	5.1
Repair (estimated)	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Administration	2.0	1.4	1.6	3.5	2.1	3.1	1.6
Direct labor	9.9	11.6	17.4	13.5	14.7	21.9	22.1
Total[a]	51.8	53.9	51.8	46.9	46.0	65.9	54.1

a/ Cost of transporting meals not included.
Where PP equals preplate, CL equals cold lunch, and HB equals hot bulk system.

The efficiency of the different functions indicates that commissaries 1 and 2 obtained their productivity advantage over the other commissaries from the serving and cleaning operations (Table 17).

Table 17. Functional Northern Commissary Labor Efficiencies 1970-71

Function	Commissary 1 PP	2 PP	3 CL	4 HB	5 HB	6 HB	7 PP
	(meals per labor hour)						
Preparation	54.1	44.8	N.A.	73.7	37.4	34.5	N.A.
Serving	119.8	153.4	N.A.	49.6	57.9	34.5	N.A.
Cleaning	121.2	148.6	N.A.	65.0	81.7	53.3	N.A.

Where PP equals preplate, CL equals cold lunch, and HB equals hot bulk system.

There was a 10.5 cent per meal (42 percent) variation in food cost between the commissaries (Table 18). The variation was caused by both the purchased food cost and the use of government commodities. Commissaries 1 and 2 used fewer commodities per meal and these were processed by sub-contractors before being used. The other kitchens used approximately the same level of commodities per meal which was slightly less than the Northern self-contained kitchens and satellite units. Removal of government commodities showed a variation in purchased food cost of

12.5 cents or 62 percent per meal with the main source of variation being the purchases of all processed foods by kitchens 1 and 2.

Table 18. Components of Northern Commissary Food Cost Per Meal, 1970-71

Component	Commissary 1 PP	2 PP	3 CL	4 HB	5 HB	6 HB	7 PP
	(cents per meal)						
Purchased food	31.9	33.2	21.2	24.1	22.1	34.7	20.5
Government commodities	2.3	2.4	4.7	4.7	6.2	5.0	4.6
Total food cost	34.2	35.6	25.9	28.8	28.3	39.7	25.1

Where PP equals preplate, CL equals cold lunch, and HB equals hot bulk system.

The supply cost for commissary kitchens (Table 14) reinforced the argument that hot bulk receiving schools would have approximately the same supply cost as self-contained kitchens. Commissary kitchens using hot bulk had supply costs around 1 cent, while the use of preplates increased the cost to over 5 cents. The cold lunch operation had the highest supply cost per meal.

The value of government commodities represented the only imputed costs included in the total cost of commissary meals. Table 19 presents the out-of-pocket cost of commissary meals when imputed costs are removed. Assuming the repair and labor costs are fixed over a certain range, food and supply costs represent the incremental cost of a change in the number of meals.

Table 19. Average Commissary Out-of-Pocket School Lunch Cost, 1970-71

Component	Commissary 1 PP	2 PP	3 CL	4 HB	5 HB	6 HB	7 PP
	(cents per meal)						
Food	31.9	33.2	21.2	24.1	22.1	34.7	20.5
Supply	5.5	5.1	6.7	0.9	0.7	1.0	5.1
Repair (estimated)	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Total labor	15.4	11.0	16.2	18.7	22.4	34.9	24.8
Total[a/]	53.8	49.5	44.3	43.9	45.4	70.8	50.6

a/ Cost of transporting meals not included.
Where PP equals preplate, CL equals cold lunch, and HB equals hot bulk system.

Commissaries 1 and 2 which use all processed foods and transport meals in a preplate form have incremental costs of close to 40 cents per meal. Continuing to exclude commissary 6, the other commissaries have

incremental costs of less than 30 cents which compares favorably to Northern self-contained kitchens and satellite units. Again the range over which the repair and labor cost would remain essentially fixed depends on the individual situation. Within this range the data indicate that large industrial type kitchens using all processed foods have a much higher incremental cost per meal than the other systems analyzed.

As with self-contained kitchens and satellite units, the cost of transportation, equipment and space have not been included in the cost data. Transportation data were taken at the commissary kitchens and are presented in Table 20. The range of transportation cost (excluding the capital cost of the truck) was from 1.0 to 3.8 cents per meal with a weighted average of 2.2 cents. Making a few assumptions allows the capital cost of the truck to be included. Assume a truck costs $10,000 and lasts 7 years. With a 7 percent cost of capital and 175 serving days, the equivalent annual cost would be less than $11 per day. Therefore, if a truck could transport meals to at least 4 schools serving an average of 300 meals per day, the cost would be less than 1 cent per meal. (Equivalent annual cost is explained in a later section.) Adding this estimate to the figures in Table 20, the cost of transporting meals is between slightly less than 2 cents and 5 cents per meal. Commissaries 2, 3 and 7 reflect special problems. Under normal conditions the cost of transporting meals including the capital cost of the truck is estimated at approximately 2 cents per meal.

Table 20. Northern Commissary Transportation Cost Per Meal 1970-71

	Commissary						
	1 PP	2 PP	3 CL	4 HB	5 HB	6 HB	7 PP
	(cents per meal)						
Transportation cost[a/]	1.0	3.8	2.6	1.1	1.1	0.8	2.4

a/ Capital cost of truck not included.
Where PP equals preplate, CL equals cold lunch, and HB equals hot bulk system.

Standards of Comparison for School Lunch Cost Components

State and federal school lunch personnel can use average cost data to make decisions, but at the local level less aggregated cost information is needed to evaluate and identify problem areas in school lunch programs. Merely knowing whether your school lunch cost components lie above or below an average is not as meaningful as some indication of the degree the component varies from the average in relation to similar school lunch operations.

Since all schools in this study with similar systems have been evaluated in the same manner using comparable data, the range of each system cost component provides standards for comparing individual lunch programs. Schools not analyzed by this study would have to use the methodology

Table 21. School Lunch Standards of Comparison, 1970-71

Region and System	ADP[a]	Purchased food cost	Government commodities	Total food cost	Supply cost	Fringe benefits[b]	Direct labor[c]	Administration[c] labor	Total labor	Total cost[d] of school lunch
	(percent)		(cents per meal)			(percent)		(cents per meal)		
Northern Self-Contained										
Highest 10 percent	88.5	33.5	6.9	37.6	2.1	39.2	34.9	7.1	41.2	77.7
Average	61.0	27.5	5.3	32.8	1.4	23.8	25.0	3.2	28.2	62.4
Lowest 10 percent	42.7	19.0	3.6	27.6	0.5	7.9	14.7	1.3	17.4	44.6
Number of districts	35	35	35	35	35	28	28	28	28	28
Northern Satellite										
Highest 10 percent	84.0	31.5	6.4	36.7	4.3	35.3	28.1	6.2	33.3	67.1
Average	55.0	26.7	5.0	31.7	1.9	15.4	16.5	2.7	19.2	52.8
Lowest 10 percent	38.8	19.8	3.0	24.7	0.5	5.8	10.4	1.0	12.7	46.3
Number of districts	21	21	21	21	21	19	19	19	19	19
Northern Mixed Systems										
Highest 10 percent	76.7	34.1	6.9	39.6	3.3	25.5	29.7	5.2	34.5	68.1
Average	55.9	27.0	5.3	32.3	2.2	15.7	22.1	2.5	24.6	59.1
Lowest 10 percent	40.3	21.1	3.6	27.0	0.7	8.0	14.5	0.9	16.5	48.1
Number of districts	32	32	32	32	32	29	29	29	29	29
Southern Self-Contained										
Highest 10 percent	103.9	29.8	12.0	38.2	3.2	18.3	21.4	2.9	23.1	57.3
Average	86.9	22.4	8.6	31.0	1.2	8.0	14.8	1.3	16.1	48.3
Lowest 10 percent	64.3	15.9	4.7	23.8	0.4	4.9	10.1	0.3	11.3	40.3
Number of schools	67	67	67	67	67	66	66	66	66	66
Southern Satellite										
Highest 10 percent	97.6	31.9	9.3	39.7	4.5	15.6	26.7	1.9	27.8	64.4
Average	68.6	25.7	6.9	32.6	2.1	11.3	20.7	1.3	22.0	56.7
Lowest 10 percent	47.1	20.4	5.0	27.0	0.6	6.7	15.6	0.8	16.9	47.8
Number of schools	35	35	35	35	35	28	28	28	28	28

a Average daily participation.
b For direct labor.
c Includes fringe benefits.
d Does not include cost of transporting meals, repair cost or capital investment.

presented in Chapter III to analyze their lunch program in order to make their results comparable. The average of the highest and lowest 10 percent, the weighted average, and the number of observations for each component are presented in Table 21. As discussed earlier, Northern observations represent district information while Southern data are individual schools or system data. The fewer number of observations for the labor and total cost of school lunch categories reflects the inability of all schools to provide this information. The total cost of a school lunch category, composed of food, supply and labor cost, contains observations from the same schools in each individual cost component. The highest and lowest percentages were computed independently for each cost component. For example, the observations used to compute the highest 10 percent for purchased food cost were not necessarily the same observations used to compute the highest 10 percent for government commodities. Consequently, except for the weighted averages, the individual components cannot be summed horizontally. Repair cost is not presented because of its relative insignificance and it rightfully belongs with an equipment cost analysis.

The results show a wide variation of costs within each category. The extent of the variation is dramatically pointed out when considering all observations. The total cost of providing a lunch varied by more than 90 percent; from a high of 77.7 cents to 40.3 cents per meal.

Labor Productivity Standards by Region, System and Size of School

One of the major purposes of this study was to determine the labor productivity of the different basic school lunch systems. Northern school lunch cost information was available only on a district basis and could not always be allocated to different systems. As a result, more than 1/3 of the districts were reported under the mixed system. However, labor hours were available for each school and system within districts and labor productivity was computed for each Northern and Southern school. The methodology used to compute meals per labor (labor productivity) was discussed in Chapter III. Each school was classified as being a self-contained kitchen, a satellite production kitchen, a satellite receiving school using hot bulk, or a satellite receiving school using a preplate system. The results were grouped according to the number of meals served per day and are presented in Tables 22 and 23 with the same breakouts used with the cost data. When the number of observations was less than 15, the highest and lowest percentages were omitted. Since only 1 of the 35 Southern production kitchens used a preplate (for 1 receiving school), data are presented on Southern satellite units using only the hot bulk system. Both preplate and hot bulk satellite systems are included in the Northern data. As preparation labor was allocated back to the receiving schools, production kitchens were classified according to the number of meals served at the school, not by the total number of meals produced. Data are presented in all cells where observations were made. However, 4 out of the 18 cells reporting Northern data and 12 out of the 18 cells reporting Southern data contain fewer than 10 observations. Caution should be used in judging the reliability

Table 22. Northern Labor Productivity by Size and Type of System, 1970-71

System	Meals per day					
	0-199	200-399	400-599	600-799	800-999	1000+
	(meals per labor hour)					
Northern Self-Contained						
Highest 10 percent	18.6	19.0	20.7	17.5	*	17.0
Average	11.2	12.8	14.3	13.5	13.3	12.3
Lowest 10 percent	7.3	8.1	8.6	8.9	*	8.9
Number of schools	29	81	59	19	12	19
Northern Production Kitchens						
Highest 10 percent	*	15.2	18.9	18.0	*	*
Average	9.3	11.1	12.2	12.2	14.4	12.8
Lowest 10 percent	*	7.6	5.6	9.5	*	*
Number of schools	2	17	20	17	8	7
Northern Hot Bulk Receiving Schools						
Highest 10 percent	20.9	24.9	23.3	*		
Average	14.7	16.4	17.3	16.3		
Lowest 10 percent	9.1	11.3	10.9	*		
Number of schools	90	72	19	5	0	0
Northern Preplate Receiving Schools						
Highest 10 percent	27.9	33.5				
Average	18.2	23.5				
Lowest 10 percent	8.6	14.1				
Number of schools	45	26	0	0	0	0

* Percentages were omitted when the number of observations was less than 15.

Table 23. Southern Labor Productivity by Size and Type of System, 1970-71

System	Meals per day					
	0-199	200-399	400-599	600-799	800-999	1000+
	(meals per labor hour)					
Southern Self-Contained						
Highest 10 percent	*	*	17.4	19.7	*	*
Average	10.1	11.5	13.1	14.7	13.6	12.2
Lowest 10 percent	*	*	10.4	10.5	*	*
Number of schools	10	5	20	24	6	2
Southern Production Kitchens						
Highest 10 percent	*	*	*	*	*	*
Average	6.1	9.7	10.3	12.0	9.9	13.4
Lowest 10 percent	*	*	*	*	*	*
Number of schools	2	6	13	6	1	6
Southern Hot Bulk Receiving Schools						
Highest 10 percent	*	21.2	27.1	*	*	*
Average	14.9	14.5	16.6	15.5	16.3	14.7
Lowest 10 percent	*	11.3	11.6	*	*	*
Number of schools	3	19	16	6	3	2

* Percentages were omitted when the number of observations was less than 15.

of these small samples to estimate labor productivity parameters. The results of the schools included in this study suggest the following:

1. Within each system and size classification there is considerable variation in labor productivity.
2. Average labor productivity in Northern production kitchens was generally less than in Northern self-contained kitchens, but Southern production kitchens had substantially lower labor productivity than corresponding Southern self-contained kitchens.
3. All receiving schools had higher labor productivity than corresponding self-contained and production kitchens. Preplate receiving schools had substantially higher labor productivity than hot bulk receiving schools.
4. The vast majority of Northern receiving schools served less than 400 meals per day, but the majority of Southern receiving schools served more than 400 meals per day.

CHAPTER V

EXPLANATORY MODELS FOR FOOD COST AND LABOR REQUIREMENTS

An Economic Model to Explain Variation in Total Food Cost

The average total food cost per meal (including government commodities) varied by less than 6 percent between region and system. However, there was a substantial difference in food cost between the highest and lowest percentage figures (Table 21). Food cost is a significant percentage of the total cost of providing a school lunch and an explanation of the variation would be of considerable interest to school lunch personnel.

School lunch programs serve 4 basic types of meals--elementary, Jr.-Sr. high school, a la carte and adult, including those served to cafeteria workers. Assuming a different cost for each meal type, schools serving different percentages of these meals would account for some of the per meal variation in food cost. Other variables which may cause variation in food cost include the type of system, region and the level of convenience foods used.

Regression techniques were used to quantify the relative importance of the individual variables in explaining the variation in the total food cost. Regression analysis not only attempts to account for the variation, but indicates the average change in a dependent variable associated with a one unit change in the value of the independent variable(s).

Since schools have different numbers of serving days, the total food cost per day for individual schools was chosen as the dependent variable. The problem of Northern school district data vs. Southern school data was solved by taking the average number of each type of meal served by each system type and counting each district as a school. A few Northern districts had the food cost for each school, which combined with the other data made a total of 207 observations. Using a form of 0,1 variables, elementary and Jr.-Sr. high school meals were tested for significance according to the type of system (self-contained vs. satellite), Northern schools vs. Southern schools, and the level of convenience food used.

A model was run containing all the above variables. The standard F test was used at the 5 percent level of significance to test for significant differences in the sum of squared residuals when explanatory variables with insignificant T ratios were removed from the equation. Removal of variables which did not make a significant difference in the sum of squared residuals would suggest that at the 5 percent level of significance the variable did not help explain the variation in total food cost per day. The following variables were found insignificant in explaining variation in food costs:

1. The index used to measure the level of convenience foods for both elementary and Jr.-Sr. high school meals. The data suggest that schools using a higher level of convenience foods did not have a

significantly higher food cost than schools using the normal level of convenience foods.

2. There was no significant difference in the total food cost among Northern and Southern schools serving elementary meals.

3. There was no significant difference in total food cost among elementary schools using satellite systems compared to self-contained kitchens.

The other variables tested were significant at the 5% level of significance resulting in the following explanatory equation of variation in total food cost per day:

$$TFC = \underset{}{4.190} + \underset{(29.8)}{0.275}\, X_1 + \underset{(22.2)}{0.298}\, X_2 + \underset{(3.1)}{0.037}\, X_3 + \underset{(2.5)}{0.028}\, X_4 + \underset{(19.5)}{0.379}\, X_5 + \underset{(2.3)}{0.350}\, X_6$$

$$R^2 = .94$$

where:

TFC = Average total food cost dollars per day.
X_1 = Average number of elementary meals served per day.
X_2 = Average number of Jr.-Sr. high school meals served per day.
X_3 = Average number of Jr.-Sr. high school meals served per day using a satellite system including those in the production kitchen.
X_4 = The average number of Jr.-Sr. high school meals served in a Southern school.
X_5 = The average number of a la carte meals served per day.
X_6 = The average number of adult meals including those served to cafeteria workers.
( ) = The regression coefficient T value.
R^2 = The percentage of total variation in food cost per day explained by the equation.

For the data used in this study the equation suggests the following:

1. The incremental food cost for Northern and Southern elementary school meals was approximately 27.5 cents per meal regardless of the system used to provide the meal. Thus, serving an additional elementary meal would add 27.5 cents to the total food cost.

2. Jr.-Sr. high school meals had an incremental food cost of 29.8 cents per meal except for the following adjustments:
   (a) Using a satellite system increased the Jr.-Sr. high school food cost by 3.7 cents per meal in both regions.
   (b) Southern Jr.-Sr. high school food cost was 2.8 cents per meal higher than Northern schools.

   These costs are additive. An additional Jr.-Sr. high school meal served in a Northern satellite system would cost approximately 33.5 cents (29.8 + 3.7). An additional Jr.-Sr. high school meal served

in a Southern school would cost 32.6 cents (29.8 + 2.8), but 36.3 cents (29.8 + 3.7 + 2.8) if served in a Southern satellite unit.

3. The incremental food cost per a la carte meal was 37.9 cents.

4. The incremental food cost for all types of adult meals was 35.0 cents per meal.

5. The equation explained 94 percent of the variation in total food cost. Overall management of the lunch program, size of portion, quality of the meal, and buying power are additional suggested variables which may explain the residual variation in total food cost. None of these variables were measured during the study.

It should be emphasized that these incremental per meal food costs have validity only for schools which analyze data in the same manner as outlined in Chapter III. In addition, the incremental per meal costs do not represent out-of-pocket food costs since the value of government commodities was included.

An Economic Model to Explain Variation in Labor Requirements

Labor productivity, which has a significant effect on the cost of a lunch, had considerable variation within each system and size classification (Tables 22 and 23). An equation using multiple regression was formulated to account for the variation.

The dependent variable was total direct labor hours per day for each school. A total of 695 schools were classified as being a self-contained kitchen, satellite production kitchen, hot bulk receiving school, or a preplate receiving school. The main explanatory variables were the 4 types of meals--elementary, Jr.-Sr. high school, a la carte, and adult--produced at each school. Using a form of 0,1 variables the labor required for all meal types, except adult, was tested for being significantly different if meals were served in schools other than a self-contained kitchen.

Interaction terms between regions (North, South) and system type, except for preplate receiving schools, were tested for significance with elementary and Jr.-Sr. high school meals. In addition, these meals were tested for significantly different labor requirements when disposable tableware was used and when meals were prepared with a relatively high level of convenience foods. The average daily participation rate was also included as an explanatory variable. The standard F test was used at the 5 percent level of significance to test for significant difference in the sum of squared residuals when explanatory variables with insignificant T ratios were removed from the equation. The original equation contained 24 explanatory variables, but testing for significance at the 5 percent level with the F test reduced the final equation to 14 variables which explained 90 percent of the variation in labor hours required per day. Basically, the model is a function of the type of meal

served, system type and regional system interaction terms. The coefficients of the variables indicate the change in labor required by a one unit change in each variable. Considering each meal type, the data from this study indicate the following:

1. Elementary meals

   A. Compared to self-contained kitchens (regardless of region), it required more labor in Southern production kitchens to provide meals to their students. Northern production kitchens were not significantly different from self-contained kitchens in labor requirements.

   B. Hot bulk and preplate receiving schools required less labor than self-contained kitchens. Preplate receiving schools required the least amount of labor.

   C. Elementary schools using disposable tableware required less labor than those using conventional tableware.

   D. Elementary schools using a higher level of convenience foods required less labor than schools using the average level.

2. Jr.-Sr. high school meals

   A. Southern production kitchens serving these meals required more labor than self-contained kitchens (regardless of region). Northern production kitchens were not significantly different from self-contained kitchens in labor requirements.

   B. Both hot bulk and preplate receiving schools required less labor than self-contained kitchens. Preplate receiving schools required the least amount of labor.

   C. The use of disposable tableware did not significantly reduce the labor required to provide meals.

   D. Higher levels of convenience foods required less labor.

3. Adult and a la carte meals

   A. Both meal types were significant in explaining labor requirements. No differences were found in a la carte labor requirements between systems and regions.

4. There was an inverse relationship found between the average daily participation and the labor hours required.

The quality of management, the number of serving lines and the amount of serving time are additional variables which would account for variation in the total labor hours required per day. These variables were not measured by this study.

CHAPTER VI

COST OF EQUIPMENT AND SPACE USING DIFFERENT SYSTEMS

To demonstrate the importance of equipment and space requirements on the cost of providing a school lunch and the effects of system type on equipment and space cost, a hypothetical district containing 4 schools was established with a total ADP of 1500 meals (Table 24).

Table 24. Cost of Equipment and Space for Hypothetical School District Using Different Systems

School	Meals per day	Equipment cost	Space		Cost per year	
			Sq. feet[a]	Cost[b]	Repairs	Tableware[c]
Self-Contained Kitchens						
A	200	$ 23,000	900	$ 32,400	$ 180	$ 60
B	300	25,600	1,100	39,600	270	90
C	400	28,600	1,300	46,800	360	115
D	600	38,900	1,800	64,800	540	175
Total	1,500	$116,100	5,100	$183,600	$1,350[d]	$440
Hot Bulk Satellite System						
A	200	$ 13,330	770	$ 27,720	$ 72	$ 60
B	300	14,400	770	27,720	108	90
C	400	15,100	770	27,720	144	115
D	600	50,000	3,200	115,200	216	175
Total	1,500	$ 92,800	5,510	$198,360	$540[e]	$440
Tray-Pack Satellite System						
A	200	$ 4,900	560	$ 20,160	$ 72	$ 60
B	300	5,100	560	20,160	108	90
C	400	5,200	560	20,160	144	115
D	600	52,700	3,200	115,200	216	175
Total	1,500	$ 67,900	4,880	$175,680	$540[e]	$440

a/ Dining room not included.
b/ Computed at $36 per square foot.
c/ Computed at $5 per dozen for 3 items.
d/ Computed at 0.5 cents per meal.
e/ Computed at 0.2 cents per meal.

It was assumed that the school district had no preference between systems and wanted to incorporate capital investment with operational efficiency in deciding which system to use. An estimate of equipment and space required for each school was made under the following situations:

1. All schools in the district utilize a self-contained kitchen.

2. School D has a production kitchen serving its students in a conventional manner, but transports meals to schools A, B and C by hot bulk.

3. The same situation as 2, but using a tray-pack type of preplate system.

Life expectancy of all equipment was assumed to be 15 years and building space 20 years. Building costs were estimated to be $36 per square foot. Annual repair costs were set at 0.5 cents per meal for self-contained kitchens and 0.2 cents per meal for satellite units. Tableware (knife, fork and spoon) requirements were estimated at 70 percent of ADP and were replaced annually at a total cost of $5 per dozen place settings.

The three systems will be evaluated using present value techniques in order to incorporate the time value of money and allow investments with unequal lives to be compared.[17] Specifically, the equivalent annual cost of each system will be computed.

Repair and tableware costs are already on an annual basis and do not require further analysis. The expenditures for equipment and building space are incurred immediately. Consequently, these expenses must be converted into annual equivalent costs to represent the annual cost for 15 years which is equal to the required investment in equipment today and the annual cost for 20 years which is equal to the required investment in building space.

The annual equivalent cost for equipment and space for each system would be the net present value of the investment divided by the present value of $1 per year for the appropriate number of years discounted by the cost of capital. The cost of capital was estimated to be 7 percent which represents the approximate real interest rate on school bond issues. Since expenditures for building space and equipment are incurred immediately, net present value would be the face value of this expense. The calculation of equivalent annual cost (EAC) for each system is as follows:

District Equivalent Annual Costs for Self-Contained Kitchens

EAC of equipment = $\frac{\$116,100}{9.1079^*}$ = $12,747

* Present value factor of $1 at 7 percent for 15 years.

EAC of building space = $\frac{\$183,600}{10.5940^*}$ = $17,331

* Present value factor of $1 at 7 percent for 20 years.

EAC of equipment and space $30,078

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17 A detailed explanation of present value and its use in decision making can be found in books dealing with managerial economics including: Harold Bierman, Jr. and Seymour Smidt, The Capital Budgeting Decision, the MacMillan Co., 1966; and Richard D. Aplin and George L. Casler, Evaluating Proposed Capital Investments with Discounted Cash Flow Methods, Dept. of Agricultural Economics, Cornell Univ., Ithaca, N.Y., 1969.

Adding the annual cost of repairs and tableware would complete the total equivalent annual cost of using self-contained kitchens.

EAC of equipment and space	$30,078
Annual cost of repairs	1,350
Annual cost of tableware	440
Total annual cost	$31,868

District total annual meals is the product of 1,500 meals per day by 180 serving days or 270,000 meals. Equivalent annual cost per meal for self-contained kitchens is the quotient of the total equivalent annual cost divided by total annual meals or:

$\frac{\$31,868}{270,000}$ = 12 cents per meal equivalent annual cost for self-contained kitchens

District Equivalent Annual Cost for Hot Bulk Satellite System

The procedure is the same as for self-contained kitchens:

EAC of equipment = $\frac{\$92,800}{9.1079}$ =	$10,189
EAC of space = $\frac{\$198,360}{10.5940}$ =	18,724
Annual cost of repairs =	540
Annual cost of tableware =	440
Total annual cost	$29,893

District total annual meals = 1,500 x 180 = 270,000

$\frac{\$29,893}{270,000}$ = 11 cents per meal equivalent annual cost for hot bulk satellite system.

District Equivalent Annual Cost for Preplate System

EAC of equipment = $\frac{\$67,900}{9.1079}$ =	$ 7,455
EAC of space = $\frac{\$175,680}{10.5940}$ =	16,583
EAC of repairs =	540
EAC of tableware =	440
Total annual cost	$25,018

District total annual meals = 1,500 x 180 = 270,000

$\frac{\$25,018}{270,000}$ = 9 cents per meal equivalent annual cost for preplate satellite system.

The above has been done in order to demonstrate the importance of capital investment on the cost of a meal. The results have relevance only to the extent that the assumptions made were reasonably correct.

CHAPTER VII

APPLICATION OF THE RESULTS OF THIS STUDY

From a rational viewpoint the school district would use the system which provided meals at lowest total cost. Adding the other cost components (food, supplies, transportation and labor) to the equivalent annual cost of space and equipment would produce the total cost per meal for each system and the district could merely choose the lowest cost method.

The other cost components can be estimated from the information in Table 6. The food cost was set at 32 cents per meal for all systems. Self-contained kitchens and hot bulk satellite systems would have the same supply cost of 1 cent per meal, but the preplate system would have a 5 cent supply cost. Both satellite systems would have a transportation charge of approximately 2 cents per meal. The cost of labor is more difficult to estimate since it is a function of wages paid and labor productivity. With an equal wage rate regardless of system, the labor cost per meal for each system would depend upon its labor productivity. The relevant question becomes: when compared to self-contained kitchens, is the increase in labor productivity and resulting savings in labor cost using satellite systems enough to offset their additional costs? A tabular form of system costs clearly shows differences:

Component	Self-contained	Hot Bulk	Preplate
	(cents per meal)		
Food	32	32	32
Supplies	1	1	5
Transportation	0	2	2
Total equivalent annual costs	12	11	9
Subtotal	45	46	48
Direct labor	?	?	?

Specifically the question becomes: would the savings in direct labor cost from using a hot bulk system be enough to compensate for its 1 cent additional cost per meal compared to self-contained kitchens, and is the saving in labor using the preplate system at least equal to 3 cents per meal? Recall that the hypothetical school district served 1,500 meals per day, of which 600 were served in a production kitchen. Meals served in a production kitchen are not transported and normally are served in the same manner as meals in self-contained kitchens. Thus, only 900 of the 1,500 meals would have a higher cost when using a satellite system. Therefore, the hot bulk system would have to save $9 per day in labor cost and the preplate system $27 per day for the total cost of each system to be equal. To determine if these savings occur, we need to know the cost of labor and the labor productivity of each system. We will assume a labor cost for direct labor of $2.50 per hour. Using the averages for Northern school lunch systems (Table 22), the labor productivity for the hypothetical school district is as follows:

Using self-contained kitchens

Average daily participation	Meals per labor hour	Product
200	12.8	2560
300	12.8	3840
400	14.3	5720
600	13.5	8100
Total 1500		20220

Weighted average district meals per labor hour = $\frac{20220}{1500}$ = 13.5

Estimated labor hours required = $\frac{1500}{13.5}$ = 111.1

Using a hot bulk satellite system

Average daily participation	Meals per labor hour	Product
200	16.4	3280
300	16.4	4920
400	17.3	6920
600	12.2	7320
Total 1500		22440

Weighted average district meals per labor hour = $\frac{22440}{1500}$ = 15.0

Estimated labor hours required = $\frac{1500}{15.0}$ = 100.0

Saving in labor cost compared to self-contained kitchens with a $2.50 labor cost = (111.1 - 100.0) x $2.50 = $27.75

Using a preplate satellite system

Average daily participation	Meals per labor hour	Product
200	23.5	4700
300	23.5	7050
400	20.0(assumed)	8000
600	12.2	7320
Total 1500		27070

Weighted average meals per labor hour = $\frac{27070}{1500}$ = 18.0

Estimated labor hours required = $\frac{1500}{18.0}$ = 83.3

Saving in labor cost compared to self-contained kitchens with a $2.50 labor cost = (111.1 - 83.3) x $2.50 = $69.50

Since each satellite system saved more in labor expense than their additional cost of operation, either type would provide meals at a lower cost than self-contained kitchens. This method of analysis also allows the satellite systems to be compared. With a 2 cents per meal cost

difference between satellite systems, the preplate system would have to save $18 per day in labor cost for it to be more economical than a hot bulk system. The difference in labor hours between a hot bulk and a preplate system is (100.0 - 83.3) or 16.7 hours. With a labor cost of $2.50 the preplate system would save (16.7 x $2.50) or $41.75 per day; more than enough to pay its additional cost of $18. Consequently, the preplate type of satellite system would be the most economical system to provide meals to the hypothetical district when all costs are considered including the capital investment.

The labor cost needed in order to make the system costs equivalent can be calculated by solving the following equation:

$$\frac{DC}{DL} = W$$

when: DC = difference in cost
DL = difference in labor hours
W = labor cost per hour

Comparing self-contained and hot bulk systems the equation becomes $\frac{\$9.00}{(111.1 - 100.0)} = W$. Solving the equation shows that at any labor cost above $0.81 per hour the hot bulk system would have an economical advantage over self-contained kitchens.

Comparing self-contained and preplate systems the equation becomes $\frac{\$27.00}{(111.1 - 83.3)} = W$. Solving the equation shows that at any labor cost above $0.97 per hour the preplate system would be more economical than self-contained kitchens.

Comparing the two satellite systems shows that at any labor cost above $1.08 per hour ($18.00/(100.0 - 83.3)) the preplate system would be favored over a hot bulk.

The preceding took into consideration the effect of capital investment on the cost of providing a school lunch. Failure to consider these costs would produce the following assumed costs per meal for each system:

	Self-contained	Hot Bulk	Preplate
	(cents per meal)		
Food	32	32	32
Supply	1	1	5
Transportation	0	2	2
Total excluding labor	33	35	39

Considering only these costs, the hot bulk system would have to save $18 per day in labor cost and the preplate $54 per day. Solving the equation $\frac{\$18.00}{(111.1 - 100.0)} = W$ shows that the labor cost would have to be above $1.62 in order for the hot bulk system to be cheaper than self-contained kitchens. A preplate system would be more economical than

self-contained kitchens when the labor cost was more than $1.94 per hour. Comparing the two satellite systems shows that when the labor cost is above $2.16 per hour a preplate system would be favored over a hot bulk system. The above demonstrates the importance of considering capital investment when comparing the costs of school lunch systems.

School districts containing larger numbers of schools would tend to favor satellite systems since the higher meals per labor hour of the receiving schools would tend to offset the lower meals per hour of the production kitchen. For example, adding 2 additional 300 meal per day schools to the hypothetical district would result in the following:

System	District meals per labor hour	Labor hours required
Self-contained	13.3	157.9
Hot bulk	15.4	136.4
Preplate	19.6	107.1

Considering capital investment and applying our formula shows that the hot bulk system is more economical than self-contained kitchens when the labor cost is above $0.70 per hour. A preplate system is favored over self-contained kitchens when the labor cost is more than $0.89 per hour. When the labor cost is above $1.02 per hour the preplate system is favored over the hot bulk. Thus, adding only two receiving schools significantly reduced the labor cost necessary for the satellite systems to be more economical than self-contained kitchens.

The regression equation which explained the variation in labor requirements can also be used in making managerial decisions. The coefficients of the variables indicate the change in labor required by a one unit change in the variable. With this type of information the saving in labor and resulting saving in cost can be compared to the unit cost of the variable. If the saving in labor cost was more than the increase in expense from using the variable, then its use would be economically beneficial to the lunch program. For example, using disposable tableware with elementary meals reduces the required labor by approximately 0.014 hours per meal or 1.4 hours per 100 meals. If labor cost $2.50 per hour, then the net cost of disposable tableware for 100 meals would have to be less than $3.50 for its use to be economically justified. The net cost of disposable tableware is not just its purchase price, but should take into consideration the savings in replacement of conventional stainless steel ware and other related costs. A high level of convenience foods as measured by our data would save more than 1 hour of labor per hundred meals served. The saving in labor cost would have to be compared to the increase in food cost to determine the net economic effect on the lunch program. The total food cost equation failed to find a significant effect on food cost using the same index to measure the level of convenience foods, but the index may not have been a fine enough measurement, or managers may be able to make compensating measures in food usage to offset the additional cost. To the extent that this is true, using more convenience foods could save labor and labor cost for the lunch program.

The obvicus use of the labor equation could be to determine the effect of system type on the labor required to provide school lunches

for a given school district. The equation shows that other variables besides those concerned with system type are causing variation in labor requirements. However, if non-system variables are assumed to be the same for all systems, then any differences in labor caused by the system variables would be clearly identified. For example, if the average daily participation rate, level of convenience foods, and the number of adult and a la carte meals were all assumed to be the same regardless of the system used, then these variables can be ignored when comparing system types. Assuming all other variables remain constant, the equation can be used to analyze the hypothetical school district for the effect of system used on the amount of labor required per day. Recall the differences considering all costs except labor were approximately 1 cent per meal more with a hot bulk system compared to using self-contained kitchens, and 3 cents per meal more using a preplate system than the self-contained kitchens. With the 4 schools serving 1,500 meals per day, of which 900 were transported, the hot bulk system would have to save $9 per day in labor cost and the preplate system $27 per day for the total cost of each system to be equal. Ignoring the adult and a la carte meals and assuming all elementary meals, the labor required by each system would be:

Self-contained kitchens

Number of meals	Labor equation regression coefficient	Labor required
200	0.065	13.0
300	0.065	19.5
400	0.065	26.0
600	0.065	39.0
Total 1500		97.5

Hot bulk system

Number of meals	Labor equation regression coefficient	Labor required
200	(0.065 - 0.009)	11.2
300	(0.065 - 0.009)	16.8
400	(0.065 - 0.009)	22.4
600	0.065	39.0
Total 1500		89.4

The labor cost necessary to make the total cost comparable to self-contained kitchens = $\frac{\$9.00}{97.5 - 89.4}$ = $1.11 per hour. A labor cost higher than this would make a hot bulk system more economical.

Preplate system

Number of meals	Labor equation regression coefficient	Labor required
200	(0.065 - 0.026)	7.8
300	(0.065 - 0.026)	11.7
400	(0.065 - 0.026)	15.6
600	0.065	39.0
Total 1500		74.1

The labor cost necessary to make the total cost comparable to self-contained kitchens = $\frac{\$27.00}{97.5 - 74.1}$ = \$1.15 per hour. A labor cost higher than this would make a preplate system more economical than self-contained kitchens.

With a 2 cents per meal cost difference between satellite systems, the preplate system would have to save \$18 per day in labor cost for it to be more economical than a hot bulk system. The labor cost which equates the two systems = $\frac{\$18.00}{89.4 - 74.1}$ = \$1.18 per hour. A labor cost higher than this would make the preplate system the most economical system to provide meals to the hypothetical district when all costs are considered including the capital investment.

Ignoring capital investment assumptions, the average difference in cost between a hot bulk system and self-contained kitchens was 2 cents per meal. The difference was 6 cents per meal between a preplate system and self-contained kitchens. Using these differences a hot bulk system would have to save \$18 per day and the preplate \$54 per day in labor expense. Using the preceding formula, the labor cost which equates the hot bulk system with self-contained kitchens is \$2.22; preplate with self-contained, \$2.31; preplate vs. hot bulk, \$2.35.

A summary of the labor cost which equates the systems using the average labor productivity figures from Table 22 and the regression equation is presented below.

	Considering capital investment		Ignoring capital investment	
Comparison	Average data	Regression equation	Average data	Regression equation
Hot bulk vs. self-contained	\$0.81	\$1.11	\$1.62	\$2.22
Preplate vs. self-contained	0.97	1.15	1.94	2.31
Preplate vs. hot bulk	1.08	1.18	2.16	2.35

The conclusions reached regarding the hypothetical school district would not necessarily be the same for all school districts. Each school district has special characteristics which have to be taken into consideration and local cost conditions would change the conclusions. The answers obtained using the regression equation assumed all meals are distributed to elementary schools and all other variables remained constant. Including high school meals would have changed the analysis since the labor coefficients are different for high school meals and, in general, save less labor than elementary meals with satellite systems. In addition, the regression equation for food cost indicates a higher food cost for high school meals, generally, and an additional food cost for those served with satellite systems. The importance of the hypothetical district was that it demonstrated how data can be used in decision making and how results can be altered with changes in assumptions and costs.

PART II. COMMERCIALLY PROVIDED SERVICES

CHAPTER I

INTRODUCTION

In recent years schools participating in the National School Lunch Program have had several new options available for provision of meals to children during school. Traditionally participating NSLP schools have owned and operated their own food preparation and serving facilities. As a result of a USDA ruling in 1970[1] school authorities could contract with food service management companies to operate their food facilities and still be able to participate in the NSLP and Special Milk Program. This action was recommended by the White House Conference on Food, Nutrition and Health[2] in 1969.

Another innovation which has gained importance in school feeding is the use of complete packaged meals produced by private business in non-school owned food plants. This type of system has been used to a rather large degree to provide complete meals in the neighborhood schools of large cities such as Detroit, Newark, and Buffalo, New York. Many of these schools previously had no food facilities and had been under considerable local civic pressure to provide food service especially to underprivileged children.

Part II of this study compares the relative cost of providing meals by school owned and operated systems as determined in Part I with the currently available options of commercially supplied meals and services.

As discussed in Part I, information concerning the cost of producing a school lunch previously reported has been extremely difficult to interpret and compare due to the lack of uniform accounting procedures or incompletely defined base data categories. The same data gathering system used in Part I was continued in Part II and the same data collectors were employed. Interviews with school lunch officials and actual examination of financial records and reports insured data accuracy and uniform comparability in both parts of this study. Data analysis techniques were the same.

During the course of the study it was found that under the broad grouping of management service options and preplate meal systems a number of alternatives were in use. These ranged from complete system packages including meals and equipment to the provision of food management advice alone. Chapter II describes the various systems encountered and provides the nomenclature and definitions used throughout Part II.

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1 Federal Register, Vol. 35, No. 41, p. 3900, Feb. 28, 1970.
2 White House Conference on Food, Nutrition and Health, Final Report, Dec. 24, 1969.

CHAPTER II

COMMERCIALLY AVAILABLE SYSTEM ALTERNATIVES FOR SCHOOL LUNCH

The two broad categories of commercially available school lunch alternatives are contract management and preplated supply systems. The primary difference between these two categories is the presence or absence of school paid food service managers. Essentially contract management provides food service management expertise as a substitute for school employed managers to operate school owned facilities. Preplate systems retain school food service managers but in most cases of this type, school owned food service facilities are minimal. Since each school district has an almost unique set of operating constraints, it is logical that a number of alternatives have been devised to meet a particular set of requirements. Obviously it would be possible for a contract system to provide both management services and facilities, but no such system was encountered during this study.

Contract Management and Operation

Two general types of companies providing management services for school feeding were found. One was the diversified management company which provided food service management for many types of organizations such as hospitals, airlines, industrial plants, clubs and schools. The other type specialized in school food service. An example of the diversified company is ARA Services of Philadelphia. This company provides services for all types of establishments requiring food services in many parts of the U.S. including the Pentagon. An example of the specialized company is the JA-CE Company of New Brunswick, New Jersey. This management company provides school food services to both public and private schools in northern New Jersey.

Services Provided by Management Companies

Dependent upon the requirements of the local school district, typical services provided by contract were summarized from an examination of all available contracts. They are described below.

a. Management Services

Management expertise is provided in the form of trained food service managers specializing in school lunch programs. Dependent upon the size of the school system, the number of schools serviced, type of production facilities, etc., the manager may be a full time or part time supervisor. Some may supervise operations in more than one school district. Normally these managers do not do any food preparation but supervise preparation, serving, and sanitation by operating personnel. Generally they provide liaison between the school district business office, operating personnel and the management company headquarters. If the school provides the operating personnel, corrective actions are recommended to responsible school officials, otherwise direct action is taken. In effect, contract managers replace school district staff food service managers.

b. Operating Services

Trained food service workers may be employed by the contractor to operate the school food service facilities. These facilities may be self-contained kitchens or satellite systems as described in Part I of this study. The contractor is responsible for all personnel actions, but most contracts examined contain provisions giving the school district some discretionary authority over the types of persons hired.

c. Bookkeeping or Administrative Services

Contract management is responsible for keeping acceptable records and accounts to meet all district, state and federal requirements. Monthly reports are furnished to the school district for preparation of state and federal reimbursement requests. The information is usually furnished to the district in a form which will permit rapid preparation of official reimbursement forms. The company is responsible for record keeping and inventory of government furnished commodities to show proper utilization.

d. Menu Planning Services

Menus which meet the requirements of the National School Lunch Program are planned by company dietitians or other suitably trained personnel and usually subject to approval by the school district. Schools which provide a la carte service usually reserve the right to specify the extent of the a la carte selections and prices. Prices for complete meals meeting the Type A pattern are also specified by the district. Schools may vary in their policy of encouraging Type A meal consumption as opposed to a la carte sales, but all contracts examined reserved this policy decision to the school. Also the company is responsible to plan for the use of government commodities where feasible.

e. Procurement Services

The contractor purchases all food and supplies used in the operation of the school food service facilities except for government commodities. Whenever feasible the contractor makes use of his buying power as a representative of several school districts or as a part of a large national company.

f. Miscellaneous Services

The contract between the school and the company usually spells out which party is responsible for equipment maintenance, general sanitation, light repair work, etc. The school pays for the services rendered but this is frequently an important factor in specifying, for example, whether the school janitor is responsible for cleaning the kitchen walls and at what intervals.

g. Special Function Services

Many schools are involved in a great number of special affairs requiring food service such as awards banquets and community affairs. While

this is not a part of the normal school lunch program, it is found as a specified extra service subject to negotiation in many of the management contracts examined. This is apparently an important problem to many school districts.

Basis for Fees Charged by Management Companies

A number of different methods for computation of fees charged by management companies was found. The terms of the contract normally specify exactly how the fees are computed. In some cases a specific amount to be paid or a limitation on school district liability is used. Contract fee terms found in districts covered by this study are as follows:

a. Percentage of Gross Sales

An agreed upon percentage of the gross cash receipts (not including subsidies) is charged. This is based on both a la carte (including Special Milk Program) and regular meal sales. In some cases free and reduced price meals are included in gross receipts by multiplying by the normal sale price (or differential for reduced price) to obtain an equivalent cash sale price. Many companies split this fee into two parts: a bookkeeping fee which covers the cost of this service, and a management fee.

b. Fixed Fee

A certain sum is agreed upon as a management fee for an entire school year. This may be paid on a monthly installment basis, but it is a fixed fee. From this fee the company usually provides both administrative and management services.

c. Per Meal Basis

A charge is made based on the number of total meals served. A la carte sales may be converted to meal equivalents at an agreed upon sales equivalent.

d. Student Enrollment

The fee is based on the official enrollment of the schools serviced and is computed by multiplying an agreed upon cost per student by the official student enrollment for the school year.

e. Liability Limitation

After all school lunch expenses (including fees) are paid, any excess income is returned to the school and vice versa, a short fall in meeting expenses is paid by the school. In some contracts a fixed amount of liability to the district is specified. Any loss over this must be paid by the contractor. This limitation feature may be found in combination with the other fee terms listed above.

Financial Record Keeping

The management company normally prepares a monthly balance sheet showing expenses (including fees) and income. The school district receives all excess of income over expense. If expenses exceed income from all sources (including state and federal reimbursement) the school district pays the management company the difference unless a liability limitation is in effect. Government commodities may be shown on the balance sheet but this is essentially a wash transaction since they will be shown as income at a fair market value and when used the same amount will be shown as an expense.

Definitions for Contract Management Operations

a. Contractor Operated

School owned food service preparation and serving facilities are operated by contractor employees under management supervision of the contractor.

b. Contractor Managed

School owned food service preparation and serving facilities are operated by school employees under management supervision of the contractor.

Preplated Supply Systems

As stated earlier, preplate systems do not normally involve the provision of management services except that most suppliers provide consultants who supervise initial organization and start-up of preplate systems. Consultant services are also usually available as a part of the normal sales and service arrangement common in industry. In general, the preplate systems are being used to overcome facilities and/or capital limitations where some type of food service is urgently required. For example, some districts have commissaries which prepare and assemble preplated meals for shipment to district schools. Examples of these were studied in Part I. Purchase of preplated meals from a private supplier could be an alternative to the construction and operation of a central commissary. The operation of the receiving schools are similar whether the meals are produced by school owned facilities or produced by industry.

The types of companies involved in manufacturing preplated school lunches are of two types. A number of large food manufacturing companies with facilities and experience in the production of complete meals are offering school lunches either on a contract basis or by direct purchase. Another type of company specializes in the provision of a complete (except for labor) meal and equipment package. The companies providing both equipment and meals were either small companies or subsidiaries of larger food companies. The larger companies seemed to prefer supplying meals only, without equipment, but most provided equipment selection and procurement assistance.

Types of Preplate Systems

Dependent upon the needs of the local school district, the following features of preplate systems are generally available:

a. Sales

Type A meals are offered by the supplier on a catalog basis. The school can order any quantities (some minimum limitation may be specified) of specific meals or a variety of meals. Quantity discount may be offered. No contract is involved other than normal buyer-seller terms.

b. Sales Contract

School signs a contract with the supplier to provide a variety of meals (possibly on a cyclical menu basis) at a certain price for a certain period of time. No other services are provided except normal customer assistance.

c. Sales and Equipment

A contract provides for supply of meals on a cyclical menu basis. Equipment for preparation and storage at schools is provided by the contractor. Maintenance of equipment may be included as well as a purchase option on the equipment.

Definitions for Preplate Systems

a. Contractor Supplied and Equipped

Contractor furnishes complete prepared meals (FOB school) with equipment required for storage and preparation. The school furnishes space, employees to operate the system, and management supervision. The school also furnishes intraschool transportation where required. Maintenance of equipment is usually included as a part of the cost.

b. Contractor Supplied

Contractor furnishes complete prepared meal. School furnishes space, equipment, maintenance, management supervision and intraschool transportation.

c. Non-Contract Preplate

Complete meals or sub-units (hot pack or cold pack) are purchased from the most advantageous source.

Delivery Modes

While milk was always supplied separately in the systems examined, the following delivery modes were most commonly found. All meet Type A pattern requirements with the addition of $\frac{1}{2}$ pint of milk.

a. Frozen Preplate

Major portion of meal is supplied frozen. Supplemental items such as bread and/or fruit may be supplied separately. Usually includes condiments and utensils. Normally delivered on disposable dishes. Some frozen meal systems supply two meal portions: one which is to be heated and another which is simply thawed and served.

b. Chilled Preplate

Same as frozen preplate except that it is delivered unfrozen.

c. Combination Preplate

Two portions of meal are supplied, one frozen usually containing the entree and a vegetable or fruit; the other chilled which may contain bread, fruit, condiments and utensils. In some systems studied a local contractor purchased frozen entree portion from a national supplier and locally assembled a chilled pack to complete the meal.

d. Sack or Box Lunch

The meal is essentially the same as the above meeting Type A requirements but a simple finger food menu allows use of a sack or box as an outer container and eliminates disposable utensils and dishes.

Fees for Preplate Systems

Regardless of the type of system used the cost to the school district is computed on a per meal basis. Volume considerations are frequently offered in both non-contract and contract supplied systems. Contracts may have more than one year limit and can be used to protect the school district against price increases.

CHAPTER III

METHODOLOGY EMPLOYED IN THE STUDY

The methodology used for this part of the study is the same as that used in Part I.

Variation in Cost Components

School lunch systems using preplate systems have the same cost components as the schools studied in Part I:

1. Total value of food used
2. Cost of nonfood supplies
3. Labor cost
4. Repair and maintenance expense
5. Equipment cost
6. Cost of space used by the lunch program

School districts using contract management have an additional element:

7. Management fee

The cost components in contract management schools are identical in character to the cost components found in school operated systems. For example, total food value consists of the purchase price of food items plus a fair market value for government commodities used. The effect of the additional component, management fees, on the overall cost of preparing school lunches is of great interest since a common belief among some school food service managers is that this fee simply adds to the overall cost.[3]

Preplate systems have the same identifiable cost components but the character of the components under such systems is such that the total cost is redistributed between components. For example, total food value less the value of milk equals the total value of preplated meals. Since preplated meals include a disposable serving dish/container and eating utensils this is included in the value. As a result it is to be expected that the nonfood supply costs would be lower than those found in other systems. Also since preparation labor value is included in the preplated meal cost, labor costs should also change. The shifts between cost components and the change in total cost is therefore of most interest.

Selection of the Schools Studied

In order to obtain information on schools using either contract management or commercially supplied preplate systems, State School Lunch Directors in the northeast and midwest states were contacted by letter. They were requested to supply the locations and names of management companies operating schools within their states. Also identification of

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3 Food Management Companies Threaten, School Lunch Journal, Nov./Dec. 1968, p. 7071.

schools using preplate systems was requested. Table 1 summarizes the survey responses. The number of school districts using preplated meals is probably understated since some districts using preplated meals do not use contracts requiring state approval. During the conduct of the study several instances of this situation were found.

Table 1. States Contacted for Information on Commercially Supplied Meals and Services, and Responses, 1972

	Number of districts utilizing:	
	Preplate	Management Contracts
Connecticut	1	0
Delaware	0	0
Illinois	0	1/
Indiana	2/	2/
Iowa	0	0
Kansas	2/	2/
Maine	0	0
Maryland	2/	2/
Massachusetts	7	3/
Michigan	16	4
Minnesota	5	4
Missouri	0	0
Nebraska	0	0
New Hampshire	0	0
New Jersey	6	23
New York	4 4/	7
Ohio	2	2
Pennsylvania	1	2
Rhode Island	0	1
Vermont	0	5
Wisconsin	0	0 5/

1/ Illinois keeps no records on contracts unless the use of government commodities is included.
2/ No response.
3/ State law prohibits use of management contracts.
4/ New York City school feeding organization crosses district lines, 11 schools reported using preplated meals.
5/ Wisconsin reported three districts actively considering food management contracts with one of these expecting to begin prior to end of SY 71-72.

As an incidental observation it was noted that several of the replies from state directors indicated a tendency to emphasize the profit motivation supposedly inherent in contract management. The following two quotations from state responses illustrate this point. "Our view has been that a non-profit program should have little interest to an essentially profit oriented organization." "We feel there is little need for the use of profit motivated school food management companies in [this state] _____." Although this observation is not interpreted to mean an anti-management company attitude on the part of some state directors, it is cited as an important factor which caused some later difficulties in obtaining information from management companies.

Once the list of school districts was obtained, selection of districts for study was begun. Due to time limitations all districts could not be visited. The effort was made to obtain a representative sample. Schools using management companies were selected by direct contact with the management company involved. Since most districts using contract management kept only state records and reports, these were not sufficiently detailed to provide the cost information required to be comparable to the results of Part I. It was here that some difficulty was encountered. As a result of the profit question cited above, the companies tended to be very concerned and somewhat reluctant to expose their operations to detailed study. This was not motivated by any fear of the discovery of excess profits but more basically a fear of publicity. Since school contracts are awarded to the low bidder in most cases a small incremental difference in bids could mean the difference between award and non-award. Thus the fear of losing a competitive advantage was distinctly evident. In order to be generally competitive with school produced meals the management company must carefully control the components of the total cost. Economies of scale are exploited where possible to provide a competitive margin and hence the lowest possible price to the school. This is an oversimplification, however it serves to show that a study which could expose all cost elements to the competition would be viewed with apprehension.

In order to obtain full cooperation of management companies assurances were made to all that information reported in this study would not in any way identify contractors by name with cost information or by other obvious means allowing inference of identity.

Selections of school districts using contract management were made in an attempt to include a range of typical districts which would be comparable to the mixed systems reported in Part I.

Selection of schools using preplated systems was made on the basis of obtaining as many different suppliers as possible plus a representative range of applications. Suppliers are not identified by name since the total cost per meal in preplate systems can be influenced by many factors not under control of the supplier. Inevitably a ranking of costs by system identifying the suppliers involved would be equated with the "best" or "worst".

All selections were coordinated through the appropriate State School Lunch Director.

CHAPTER IV

ANALYSIS AND RESULTS OF THE STUDY

Dimension of the Study

A total of 37 school districts representing 397 individual schools were included in the study. In districts using contract management all schools with contract food service were included in the data. A few districts were found with schools having food service with both contract management and without. The records kept by the contractor were completely segregated in all such cases and no problems were caused by this type of arrangement.

Table 2. General Data on Sample Studied in Part II

	States	Supplier/ Contractor	Districts	Schools	ADA	Meals/ day
Contract management	4 1/	5	17	110	96,192	55,436
Preplate	8 2/	11	20	287	131,319	70,614
Totals		16	37	397	227,511	126,050

1/ Ohio, Michigan, New Jersey, New York.
2/ New York, Michigan, Massachusetts, Minnesota, Ohio, New Jersey, Connecticut, Illinois.

Table 2 shows the general characteristics of the sample of school districts. The school districts using preplate systems averaged over twice as many schools per district as those using contract management. This was due to the inclusion of some large city preplate systems with a large number of elementary schools on this type of service. The average number of meals per day in contract management schools is approximately 500, while the preplate systems averaged about half that amount. This is indicative of the fact that a large number of these preplate schools are rather small neighborhood schools.

Further evidence of the different character of the schools contained in the two systems is shown in Table 3. The majority of meals served in preplate systems was either free or reduced price, while contract management schools averaged only slightly over 8 percent. It was found during the conduct of the study that many schools using both systems were offering only free or full price meals. Reduced price meals were not used. Only a few schools using preplate systems utilized the reduced price category.

Table 3. Percentages of Free, Reduced Price, A la Carte Meal Equivalents and Elementary Schools in Sample

	Free	Reduced price	A la carte	Elementary schools
Contract management	8.2	0	36.4	33
Preplate	60.1	10.7	2.5	97

Practically all schools using preplate systems were elementary schools, while contract management schools were only about one-third elementary schools. The very low a la carte percentage shown by preplate systems is explained by the fact that the only extra items sold in most preplate systems was extra milk. The importance of a la carte sales in secondary schools is shown by the fact that in contract management schools over one-third of all meals served were contributed by a la carte equivalents.[4] This includes extra milk as in the preplate systems. As explained in Part I the importance of including a la carte sales in determining overall labor productivity is emphasized by this high percentage.

Average Cost of Providing a School Lunch, A Comparison of the Results of Part I and Part II

In Part I data was presented by region and system. In this section selected data from Part I will be repeated and compared to the results of the analysis of the data obtained during this part of the study.

Table 4 shows a comparison of selected data from Part I and the same data for contract managed and preplate systems. All categories from Part I are shown, however the contract management systems are most similar in nature to the northern mixed school, while the preplate systems are best compared to northern satellite systems as far as average cost per meal.

Purchased Type A percentages in all three northern school categories are from 15 to 20 percent higher than purchased Type A meals in management schools. Free Type A meals are slightly higher in management schools but there were no reduced price meals. The major offsetting factor in management schools reducing the number of purchased Type A meals is the greater percentage of a la carte sales over that shown in the other systems. One reason for this higher percentage of a la carte sales was due to the fact that some contractors did not segregate adult Type A purchases but rather included their sales value as a part of a la carte sales. Comparing the three northern percentage values for adult and cafeteria meals with the same management column value shows a difference of about 2 percent. An allowance for this slight inflation of a la carte percentage still leaves the management system a la carte percentage almost 15 percent higher than comparable northern school percentages. The a la carte percentage difference between southern systems and management systems is about 30 percent.

There is no simple explanation for system differences in Type A meal and a la carte percentages. Some factors which may be causes of variation between these categories are:

1. Grade levels served - Higher grades may demand more variety.
2. Pricing policy - Is a complete meal a better value than a la carte?
3. Menu selections - Does Type A compete in taste appeal?
4. Home packed lunches - Only milk and supplements are purchased.

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4 See Part I for a la carte sales conversion method. The same method is used in Part II.

Some management companies and districts were establishing programs to encourage increased purchases of Type A meals. An example is the "Rainbow Lunch"[5] which rewards the purchase of a complete Type A lunch with a lower total price than separate a la carte selections (each food group is matched with colors of the rainbow).

The picture presented by the preplate systems is rather different. Although over two-thirds of the meals were free or reduced price, the average daily participation rate is the lowest of all seven system categories. The difference in free meal percentage is due to the fact that many of the preplate systems studied were in essentially low income, inner city areas. The preplate systems have been utilized to provide "quick-fix" solutions in many areas due to local pressure on school districts. The low overall participation rate may be somewhat surprising in view of the high percentage of free meals provided. Information is not available as to whether or not the 47 percent not participating were ineligible for free lunch or simply did not want to participate.

A la carte percentage in the preplate schools is much lower than the other northern schools and slightly lower than the southern schools. This is because the only item offered for sale in the preplate schools (with very few exceptions) is extra milk.

Comparison of average costs from Part I and management and preplate systems is shown in Table 5. Total average costs of management and preplate systems compare favorably with all categories except southern self-contained kitchen schools which has the lowest average cost of all systems.

The average lunch costs in northern mixed system schools and the management system schools are identical. The average labor cost in northern mixed systems is 24.6 cents, while the management system labor cost is 20.2 cents. The aggregate of management system total labor and management fee costs equal 24.3 cents or .3 of a cent per meal lower than the northern mixed system labor cost. The other cost components differ by only a few tenths of a cent. This comparison of average meal costs does not appear to support the assumption that management fees are simply an additional cost to the overall cost of producing a school lunch. Total average meal cost in management system schools is about three and a half cents less than the average meal cost in northern self-contained kitchen schools.

Although preplate systems total meal cost is not too different from the average cost in other system categories, the individual cost components exhibit a significant rearrangement. As to be expected, the total food cost is the highest of all systems since the preplated meal cost includes preparation labor, disposable utensils, and some associated equipment and maintenance costs. Offsetting changes in the other cost components bring the aggregate cost back to a point lower than both northern self-contained kitchens and mixed systems.

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5 ARA Services, Philadelphia, Pennsylvania.

Table 4. A Comparison of Selected Data[1/] From Part I and Part II

Item	Part I					Part II	
	North			South			
	Self-contained	Satellite	Mixed	Self-contained	Satellite	Contract	Preplate
Average daily attendance	83,677	66,354	191,007	40,152	61,901	96,192	131,319
Total meals per day	54,042	38,533	111,659	36,473	44,788	54,070	70,614
				(percent)			
Average daily participation	61.0	55.0	55.9	86.9	68.6	56.2	53.1
Purchased Type A	68.6	70.1	72.3	67.4	68.3	52.9	25.5
Free Type A	7.6	5.5	2.2	21.0	16.9	8.2	60.1
Reduced price Type A	0.7	0.4	0.8	1.7	4.7	0.0	10.7
A la carte equivalents	17.6	18.7	20.3	5.5	4.9	36.4	2.5
Adult and cafeteria workers	5.5	5.3	4.4	4.4	5.2	2.5	1.2
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0

1/ Part I, Table 5, page 35.

Table 5. Comparison of Average Lunch Costs[1/]

Cost component	Part I					Part II	
	North			South			
	Self-contained	Satellite	Mixed	Self-contained	Satellite	Contract	Preplate
Total meals per day	54,042	38,533	111,659	36,473	44,788	54,070	70,614
Food	32.8	31.7	32.3	31.0	32.6	32.4	52.4
Supply	1.4	1.9	2.2	1.2	2.1	2.5	.4
Repair	0.5	0.2	0.3	0.4	0.2	.2	.1
Total labor	28.2	19.2	24.6	16.1	22.0	20.2	5.6
Management fee	-	-	-	-	-	4.1	-
Total	62.9	53.0	59.4	48.7	56.9	59.4	58.5
Meals per $	1.57	1.89	1.68	2.05	1.76	1.68	1.71

1/ Part I, Table 6, page 36.

Comparison of Average Labor Cost Per Meal

A general discussion of the reasons for labor cost variations is contained in Part I and will not be repeated here. Table 6 presents a comparison of average labor cost disaggregated into direct labor costs, direct labor fringe benefits and administrative costs.

Total labor cost per meal is about one cent higher in management system schools than in northern satellite schools. Northern self-contained and mixed schools are, respectively, about 6 and 4 cents higher in labor cost per meal than management system schools. Direct labor costs in management system schools are the lowest of all systems except those in southern self-contained schools. Direct labor fringe benefit costs however are about equivalent to fringe benefits in the northern mixed system which would tend to bring the total per meal labor cost to a point over southern schools.

Administrative costs per meal are the lowest under management systems but this is to be expected. Actually these average meal administrative costs may be overstated. During the school year that these data represent, some schools on their first year under management systems contracts had retained full time district staff food service supervisors. Since that time these district supervisors were found to be unnecessary and as a result administrative costs would today in these districts be much lower. Administrative costs to the district are minimal, consisting of secretarial time required to transfer operating data to the required reimbursement forms. The district business manager normally is the line supervisor responsible for food operations and he or an assistant must devote time to review of reimbursement documents, contract supervision and any extraordinary food problems that may arise. This cost is relatively constant and would tend to vary inversely on an average cost per meal basis with increased school size. The number of individual food operations would probably have some increased effect merely due to visits performed from time to time by district staff. In schools where management systems had been in effect for several years, district business managers uniformly estimated very small administrative cost.

Preplate systems show the lowest per meal direct labor cost plus the lowest per meal fringe benefit cost for all systems. This is because the majority of workers in these type systems are part time and work less than three hours per day. In some cases they received no fringe benefits at all and in others only minimal fringe costs were associated with this category worker.

Labor productivity in management schools is higher than all other systems except preplate systems. The high productivity of preplate systems is logical since most preparation labor has been performed outside the system and is built into food costs.

Using labor productivity to calculate labor cost per hour shows that management and preplate systems are approximately equal to the northern systems.

Table 6. Comparison of Average Labor Cost Per Meal[1/]

Component	Part I					Part II	
	North			South			
	Self-contained	Satellite	Mixed	Self-contained	Satellite	Contract	Preplate
Direct labor cost	20.2	14.3	19.1	13.7	18.6	17.1	3.8
Direct labor fringe benefits	4.8	2.2	3.0	1.1	2.1	2.8	.4
Administrative[2/] costs	3.2	2.7	2.5	1.3	1.3	.3	1.4
Total labor cost/meal	28.2	19.2	24.6	16.1	22.0	20.2	5.6
Labor productivity[3/] (meals/labor hour)	12.60	13.98	12.99	13.22	12.76	14.26	55.68
Labor cost/hour	$3.15	$2.31	$2.87	$1.96	$2.64	$2.83	$2.34
Meals/$ spent[4/] on labor	4	6.1	4.5	6.8	4.8	5	23.8

1/ Part I, Table 7, page 37.
2/ Includes administrative fringe benefits.
3/ The product of direct labor cost plus fringe benefits by meals over labor hours.
4/ Reciprocal of direct labor cost plus fringe benefit cost.

As found in Part I, labor cost variations between regions was the outstanding factor causing difference in average labor cost per meal. Table 7 is a comparison of all systems average meal costs assigning a common labor cost of $2.50 per hour (including fringe benefits). Other cost components from Table 5 remain the same.

Management system average meal cost is not much different from northern self-contained kitchens and mixed systems average meal costs after conversion to a common hourly labor cost. The effect on preplate systems was to raise the total per meal cost. This is because the calculated average hourly labor cost (shown in Table 6) is less than the $2.50 standard.

Labor productivity by functional groups for the seven different systems of Parts I and II are shown in Table 8. In classical labor productivity or work sampling studies, observers record worker actions at various times throughout a work period to obtain an approximation of productive and non-productive effort. Such studies are time consuming and expensive to conduct. The present studies relied upon knowledgeable estimates by food service managers of the time spent on each activity. Efficient food preparation practices, such as progressive cookery or split preparation[6] tend to blur the distinctions between the functional areas. For example, dehydrated potatoes may not be reconstituted for mashed potatoes until the serving line quantity drops to a certain level. Food preparation and serving are then going on at the same time. The manager of one contract operation stated that he stressed a "clean as you work" policy meaning that workers may be constantly preparing and cleaning at the same time.

The total number of labor hours used to compute the labor productivity of the alternative systems in Parts I and II is based on recorded experience. The partitioning of these total hours into functional areas, for reasons given above, should be used more as guides or indicators in evaluating system differences. Contract schools appear to be about the same or a little better than all systems except northern satellite and preplate systems. Serving productivity is influenced to such a degree by the length of serving periods that it is doubtful if it could be used to measure system efficiency. However school administrators should be aware of the costs associated with serving hours and periods. Preplate schools were frequently observed with short single serving periods and this may account for the extremely high productivity figures shown.

Preplate labor productivity values are very high in all functional areas as would be expected. Apparently the preparation labor, disposable utensil features and general simplicity of these systems can lead to highly efficient operations if used properly.

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6 There are arguments in the food preparation area as to the exact meaning of these two terms, but they are both used to describe the technique of splitting total food to be prepared into smaller quantities each being started at different times. This avoids the practice of cooking one large batch of food, some of which is held for the entire serving period. This is especially important in cafeteria operations spanning a considerable time period. It can result in fresher food and less waste if done properly.

Table 7. Average School Lunch Cost Comparison Assuming Direct Labor Cost of $2.50[1/]

Component	Part I					Part II	
	North			South			
	Self-contained	Satellite	Mixed	Self-contained	Satellite	Contract	Preplate
Food	32.8	31.7	32.3	31.0	32.6	32.4	52.4
Supply	1.4	1.9	2.2	1.2	2.1	2.5	0.4
Repair	0.5	0.2	0.3	0.4	0.2	0.2	0.1
Administrative	3.2	2.7	2.5	1.3	1.3	.3	1.4
Direct labor	19.8	17.9	19.3	18.9	19.6	17.5	4.5
Total	57.7	54.4[2/]	56.6[2/]	52.8	55.8[2/]	57.0	58.8[2/]
Meals per $	1.73	1.84	1.77	1.89	1.79	1.75	1.70

1/ Part I, Table 8, page 39.
2/ Cost of transporting meals not included.

Table 8. Comparison of Functional Labor Efficiencies[1/]

Function	Part I					Part II	
	North			South			
	Self-contained	Satellite	Mixed	Self-contained	Satellite	Contract	Preplate
Preparation	31.5	37.5	30.4	26.3	30.2	35.4	182.7
Serving	51.7	49.2	57.0	74.6	59.0	42.1	194.7
Cleaning	41.4	49.6	46.8	49.6	48.5	65.1	280.4

1/ Part I, Table 9, page 39.

Average Food Cost Per Meal

Table 9 shows the average food costs for the seven systems studied. Management system purchased food costs per meal are slightly higher than the systems studied in Part I, although the difference is very small. The average per meal use of government commodities is slightly less, by about one-half cent, than the three northern systems.

Preplate meal schools have the highest purchase food cost overall for previously discussed reasons. In order to obtain an estimate of the food value in a preplate meal, the values found for labor and supply in a commissary operation from Part I can be subtracted. Average supply cost in a preplate commissary is about 5 cents per meal and labor is between 11 and 24 cents. If the low labor value is used, then we can subtract 16 cents from the preplate meal value to obtain about a 36 cent residual food cost. Using the high labor value there would be about a 23 cent food cost. This is only a rough estimation and in order to evaluate differences properly the volume of meals, number of schools, etc. would have to be taken into consideration.

The use of government commodities in preplate schools is very low in general. All manufacturers contacted indicated a willingness to use these foods, however many school lunch directors expressed concern over the difficulties involved in obtaining government permission to provide commodities to their supplier for processing. Since approval is granted on a case by case basis, if schools change suppliers they must resubmit applications for new suppliers. This appears to limit the rapid exploitation of commodity values in preplate operations. Since many school districts with preplate systems had other schools with kitchens, the value of the commodities was not lost to the district since these foods could be used in the other schools. Data was not available on this reallocation and hence the low utilization only indicates the low commodity utilization value to that portion of a district's system using preplate meals.

Standards of Comparison for School Lunch Cost Components

As pointed out in Part I, aggregate cost data are more useful at state and federal levels. The data presented in Table 10 show the range of values for management and preplate systems which could be more useful for school administrators to use in comparing available alternatives to their own operations.

Due to the smaller size of this sample it was decided to show variation by presenting weighted average cost values for the top three and bottom three districts in the two systems. This makes the interval sizes approximately equal to the percentile interval used in Part I.

The variation between the top and bottom three districts weighted average cost in preplate schools is 25.1 cents as opposed to 20.6 cents variation in management schools. The source of this variation in preplate schools appears primarily to be caused by variations in total food cost. Some preplate schools had contracts which provided for a varied

Table 9. Comparison of Components of Average Food Cost Per Meal[1/]

	Part I					Part II	
	North			South			
	Self-contained	Satellite	Mixed	Self-contained	Satellite	Contract	Preplate
Purchased food[2/]	27.5	26.7	27.0	22.4	25.7	27.9	51.9
Government commodities	5.3	5.0	5.3	8.6	6.9	4.5	.5
Total food costs	32.8	31.7	32.3	31.0	32.6	32.4	52.4[3/]

1/ Part I, Table 10, page 40.
2/ Includes government commodities warehousing and transportation charges.
3/ Includes supply and services costs offset by reductions in other meal cost components.

Table 10. School Lunch Standards of Comparison[1]

System	ADP[2]	Purchased food cost	Government commodities	Total food cost[3]	Supply cost	Fringe benefits[4]	Direct labor	Administration labor[5]	Total labor	Fee	Total cost of school lunch[6]
	(percent)		(cents per meal)			(percent)					
Preplate											
Top 3	64.5	62.5	0.1	62.6	2.1	5.7	4.6	2.1	6.7	-	71.5
Average	53.1	51.9	0.5	52.4	.4	9.0	4.2	1.4	5.6	-	58.4
Bottom 3	56.4	41.3	0.0	41.3	0.0	8.1	4.1	1.1	5.2	-	46.4
20 districts										variation	25.1
Contract											
Top 3	56.9	31.1	4.5	35.6	2.6	13.9	22.2	.4	22.6	3.9	64.7
Average	56.2	27.9	4.5	32.4	2.5	14.3	19.9	.3	20.2	4.1	59.2
Bottom 3	59.6	26.2	3.0	29.2	2.0	15.4	17.2	.4	17.2	4.1	44.1
17 districts										variation	20.6

1/ See Part I, Table 21 for equivalent data on school operated self-contained, satellite and mixed systems.
2/ Average daily participation.
3/ Supply and labor costs are included in preplate purchase price.
4/ For direct labor.
5/ Includes fringe benefits.
6/ Does not include cost of transporting meals, repair costs or capital investment for contract schools.

menu at a fixed price per meal, while others bought only meals which were most acceptable. These meals tend to be higher priced, containing entrees such as fried chicken as opposed to lower priced items such as macaroni and cheese. No attempt was made to evaluate a district's average food cost with the menu items purchased but this could be a source of variation. The range of cost in this respect could be subject to much tighter management control under preplate systems since the effect of menu selections on purchase price can easily be calculated.

Another cause of variation in average food cost is waste caused by over-ordering from the contractor in the case of chilled meals, or by heating up too many frozen meals. Public health regulations in most cases do not allow meals to be refrozen or chilled once they have been heated. Chilled foods also have a relatively short storage life. Some waste is to be expected since some children who normally eat will be absent. The magnitude of the waste factor can be controlled but requires careful coordination between the supplier and food service managers. This is especially critical in chilled delivery systems since meals are made up only a few hours prior to serving. One school district had essentially no waste in a frozen preplate system because the classroom teachers called in an accurate count of children to be fed after school had started. The correct number of meals were then withdrawn from frozen storage after this morning count had been called in. Other schools, especially larger districts, relied on weekly estimates for meal quantity orders. An important part of a chilled meal contract is the time limit set for last minute changes in meal quantities ordered. Some contracts allow changes but an increased price is charged after a certain time limit. Estimated waste ranged from less than one percent of the total meals served per day to as high as ten percent in some cases. Especially difficult cases observed were the "open" type schools where attendance fluctuated widely.

An illustration can show the effect of waste on average food value. If 1000 meals are ordered at a delivered price of .50 each, the total cost is $500. If only 950 children consume meals, then the average meal cost is about 52.5 cents for that day and there is no reimbursement for over-ordered meals. Waste is a factor in hot bulk systems also but its effects are not as easily isolated as they are under individual meal systems.

Supply costs in preplate systems showed wide variations. The contribution to the average cost is however normally low. In some cases the cost of garbage disposal was added to the overall supply cost. Armored car service was also a significant expense in some systems.

Labor cost variations are not major sources of variation except when considering regional differences. This has already been discussed.

Administration costs in management systems are in general low, being offset by the management fee. One cause of higher costs is the practice of retaining a district staff food service supervisor in addition to contract management. In very large districts serving a large number of meals the average meal cost is increased by only a small amount. However in a small school district the salary of one full time supervisor

can have a rather large incremental effect on the average meal cost. In one relatively small school district the average administrative cost was 2.3 cents per meal as opposed to the average of .3 cents because of one full time district staff member hired to supervise food service operations which were under contract operation.

Administrative costs in preplate systems do not constitute a major cost component but some problems are encountered here. Most of the districts using preplate systems also had regular schools with kitchen facilities. The allocation of administrative labor cost to the preplate portion of the district system appeared to be high in some cases. This was evident in some districts where administrative costs almost equaled labor costs. With higher fringe benefits and salaries for administrative personnel as opposed to part time, low fringe benefit workers, this is not necessarily unreasonable. This problem was less critical in the larger districts since there were normally separate staff personnel supervising these schools and costs were easily identifiable. In others the judgment of the administrative personnel was all that determined the amount of administrative time spent on preplate systems. In some recently implemented preplate systems the staff personnel probably spent an inordinate amount of time involving start-up and training of personnel. This factor may have influenced the allocation of time to preplate and thus a slightly higher administrative cost than would be estimated under "normal" operating conditions.

Management fees are calculated in several different ways. Surprisingly the average per meal cost is about the same regardless of the method used to calculate fees. This narrow cost range seemingly indicates that a very competitive situation exists.

Application of the Data in This Study

This study does not recommend that any particular system or alternative be adopted on the basis of lowest average per meal cost. It does seek to provide cost component data, gathered and analyzed in a manner that allows meaningful comparisons between the alternatives available today for school feeding. Rising labor costs and shortage of capital are causing school districts to look for more efficient methods of providing school meals. It should be stressed that there is no single, all purpose food system which can be adopted to meet all requirements. Detailed analysis and decision making is required on the part of school officials to determine the best method applicable in each case. The average cost data presented here and in Part I can be of great assistance in making these crucial decisions.

System Selection Considerations

Preplate Systems

As mentioned earlier in this report, preplate meal systems have been the method used in many cases to meet urgent social pressures for expanded food service. Some food service managers expressed the opinion that they would prefer to operate their own "preplate" preparation facilities but

that assets were not available for construction of the required facilities. Their primary reason seemed to be based on a feeling that they could provide a "better quality meal" than that supplied by industry. The problems involved in scaling up from a number of self-contained kitchens and satellite systems to large scale commissary manufacturing of meals should be thoroughly considered. The high capacity equipment and production systems required in central commissaries more closely resemble the factory methods of industry rather than just larger capacity kitchens. The skills involved in management and operation of a central commissary are different in many cases from those required in smaller operations. The labor market for the new skills may not exist in certain areas or more important, the school may have to compete with the large scale food processors for labor. A further consideration is the distribution system required and its cost. System maintenance costs for large scale production equipment and transportation assets may become significant in average meal costs when full time maintenance personnel needs are considered. As a minimum the cost of building a commissary plus its projected operating costs for a period of 10 to 15 years should be evaluated using net present value techniques as opposed to the alternative of buying commercially produced meals.

A serious problem involved in commissary construction is the accurate matching of school population projections and subsequent total meal requirements to production facilities. Shifts in school population may result in a requirement for additional commissary capacity or possibly in the other direction, underutilized facilities. Commercial preplate systems will require only minor considerations in equipment at the receiving schools and increased or decreased ordering quantities.

Preplate systems should not be considered as a panacea for school district problems. A limit to their application currently seems to be that for use in secondary schools where students demand more variety in their food selections, the preplate meals are too restrictive for general acceptance. Preplate systems are currently fulfilling definite needs in many schools, particularly at the elementary levels, and are definitely worthy of consideration as an alternative to school produced meals from both a practical and economic viewpoint.

The question of insurance of equal "quality" meals, whether produced by school or industry, is beyond the scope of this report. However given the proper safeguards (by industry standards and/or government regulation) to insure highest quality meals commensurate with cost, it does not seem unreasonable to assume that commercial processors can provide meals of at least equal quality to that produced by schools.

Management Systems

As seen in the analysis of the average costs per meal of alternative systems, management contracts essentially provide a substitute for school staff personnel. Despite the addition of a management fee, average meal costs are in many cases lower than school managed systems average meal cost. While all districts would not necessarily want to change systems based on a slightly lower cost per meal, there are areas where personnel